MERRIMACK RIVER BASIN
BRISTOL, NEW HAMPSHIRE

NEWFOUND LAKE DAM
NH 00137

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

The original hardcopy version of this report contains color photographs and/or drawings. For additional information on this report please email

U.S. Army Corps of Engineers
New England District
Email: Library@nae02.usace.army.mil

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00137	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Newfound Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE October 1978 13. NUMBER OF PAGES 62
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Bristol, New Hampshire
Newfound River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a concrete masonry and timber dam structure founded on a timber crib. It is 117 ft. long and 12 ft. high. The overall condition of the dam is good as a result of a rehabilitation and modification completed in 1977. Preliminary analysis indicate the spillway has a capacity to pass only 19 percent of the spillway design flood (SDF), which in this case is the PMF.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Newfound Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire and owner of the project.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NEWFOUND LAKE DAM

NH 00137

MERRIMACK RIVER BASIN

BRISTOL, NEW HAMPSHIRE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Newfound Lake Dam, I.D., NH 00137
State Located:	New Hampshire
County Located:	Grafton
Town Located:	Bristol
Stream:	Newfound River
Date of Inspection:	June 5, 1978

BRIEF ASSESSMENT

Newfound Lake Dam is a concrete masonry and timber dam structure founded on a timber crib. The dam which is 117-ft. in length and 12-ft. in height, consists of three sections: a timber dam built at the right abutment, an adjacent sluice gate section and a newly built stop plank section at the left abutment. The dam has a spillway length of 43 ft.-6 in. on the timber dam plus 13-ft. on the new stop plank section for a total length of 56-ft.-6 in.

The overall physical condition of Newfound Lake Dam is good as a result of a rehabilitation and modification completed in 1977.

Preliminary analyses indicate the spillway has capacity to pass only 19 percent of the Spillway Design Flood (SDF), which in this case is the Probable Maximum Flood (PMF). However, more detailed hydraulic studies of the channel upstream and downstream of the dam are needed to determine relationships between water levels at the lake versus those at the dam and the effect of possible submergence at the dam by backwater during major floods.

Recommended actions to be carried out by the owner, within 24 months after

recipt of this Phase I Report, are summarized in Section 7. The most important of these is the acquisition of sufficient date to produce a comprehensive as-built set of drawings for the dam and its foundation.

Robert Gershowitz, P.E.

This Phase I Inspection Report on Newfound Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

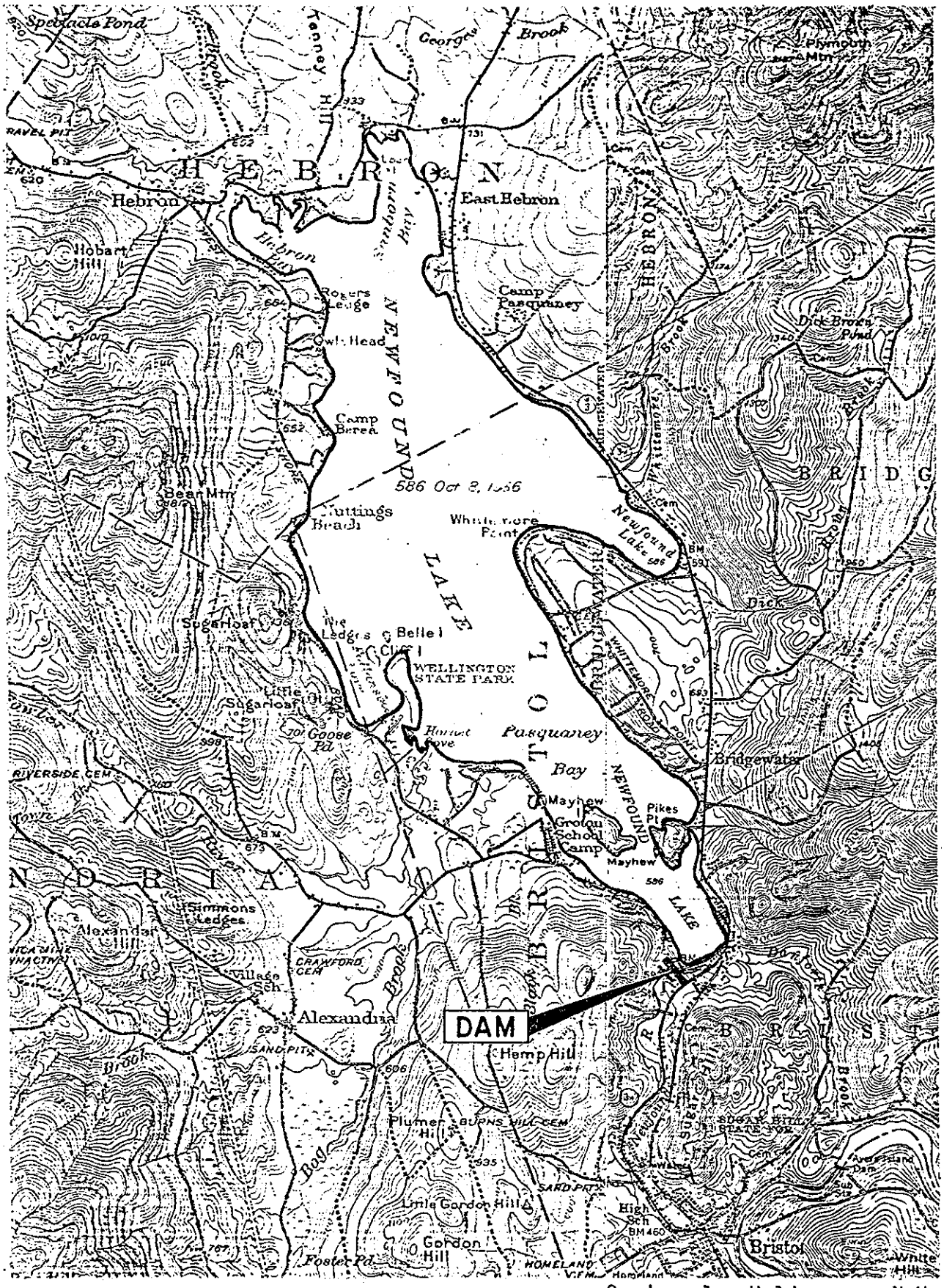
TABLE OF CONTENTS

(Continued)

APPENDICES

N E W F O U N D L A K E D A M

General view of the dam from downstream



Quadrangle: Holderness, N.H.
Scale: 1" = 2000'

VICINITY MAP

PHASE I INSPECTION REPORT
NEWFOUND LAKE DAM NH 00137

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The dam is located on the Newfound River approximately 500 feet downstream along the river channel outlet of Newfound Lake in the Town of Bristol, Grafton County, New Hampshire. The Newfound River is a tributary of the Pemigewasset River, and is part of the Merrimack River primary drainage basin.

b. Description of Dam and Appurtenances

Newfound Lake Dam is a concrete masonry and timber dam structure founded on a timber crib. The dam consists of three distinct sections. A timber dam, approximately 48-foot long, is built at the right abutment terminating at a concrete or masonry abutment wingwall. This timber dam has 12 sets of stop plank openings approximately 3 ft.-6 in. wide. On the left, the timber dam is separated from an adjacent sluice gate section by a massive concrete faced masonry pier approximately 13.5-foot wide. The sluice gate section contains three 6 by 6-foot timber sluice gates operated manually or by portable electric drill power. The sluice gate section is separated on the left from an adjacent newly built stop plank section by a massive concrete faced masonry pier 11.5 foot wide on which a gate access house has been built. The stop plank section consists of 2 bays approximately 4.67-foot wide by 6.7-foot deep below the full lake elevation of 589.1. The stop plank section terminates at the left abutment wingwall.

The dam is founded on a timber crib set into the river channel. The foundation materials on the river bed are believed to be coarse silty gravelly sands.

Newfound Lake has a surface area of 4,410 acres impounding 27,715 acre-feet of water derived from a 95 square mile drainage area. The lake is of natural origin, but its level has been raised by the construction of

the dam. The reservoir rim has been developed with summer cottage type residences along significant parts of its perimeter. The downstream channel of the Newfound River is well defined and unobstructed in the immediate downstream reach. A smaller dam structure downstream of Newfound Dam utilizes lake releases from the dam for power generation.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "Intermediate", since its storage is more than 1,000 acre-feet but less than 50,000 acre-feet. The dam is classified as "Small" because its height is less than 40 feet. The overall size classification is the larger of these two classifications, and accordingly Newfound Lake Dam is classified as "Intermediate" in size.

d. Hazard Classification

The dam has been listed in the National Inventory of Dams as having High Hazard Potential, on the basis that in the event of failure of the dam and its appurtenances, excessive damage could occur to downstream property together with the possibility of the loss of more than a few lives. The current inspection concurs with this classification because the dam impounds a very large volume of water and is founded on erodible materials. In case of dam operating accident or failure, the downstream community of Bristol would have only approximately 7 to 10 minutes to institute emergency flood evacuation procedures from low lying areas of the community along the stream channel.

e. Ownership

The dam is owned by the New Hampshire Water Resources Board (NH-WRB), headquartered at Concord, New Hampshire.

f. Operator

The Newfound Lake Dam is operated by the N.H. Water Resources Board, headquartered at Concord, New Hampshire - Telephone: (603) 271-3405.

g. Purpose of the Dam

The purpose of the dam is recreation and flood control.

h. Design and Construction History

A dam has been located at this particular location since 1840, originally for the regulation of power development downstream. As development around the lake increased, the concern with regulating the lake level has also increased. Power is still being generated at an impounding structure in the downstream river reach. Ownership of the dam passed to NH-WRB in 1974. Ending in 1977, the dam was modified and refurbished by the NH-WRB by the removal of a permanent spillway crest section and replacing it with a 3-bay stop plank section. At the same time, the existing sluice gate section was replaced by a new one containing three 6 by 6-foot sluice gates. The existing masonry piers between the timber dam and the sluice gates and between the sluice gates and the stop plank section were resurfaced with reinforced concrete. The left abutment masonry wingwall was also resurfaced and a cutoff wall section tying into the abutment was added at the upstream end of the wingwall. No construction history of the timber structure on the right abutment was uncovered in available NH-WRB records. Parts of the masonry and timber crib foundation date to the original dam construction in 1846.

i. Normal Operating Procedures

Newfound Lake Dam is operated by the NH-WRB for recreation and flood control purposes. The lake level is very closely monitored by an automatic level recording device combined with telephonic data transmission to the NH-WRB headquarters in Concord. The lake level is considered

"flashy" by the NH-WRB dam operator, meaning that the lake level can show wide variations after normal amounts of precipitation falling on its watershed. The summer cottage residents along the shore are very sensitive to water level fluctuations, and frequently low and high water complaints are received at the same time.

In the summer time, the water level is regulated at 6.5 feet as measured on the staff gage at the lake's natural outlet corresponding to 588.38 MSL. In the past few years, the summer time level has been kept below the normal full lake level (7.24 gage, 589.12 MSL), at the request of summer residents. During the summer months, the lake level is gradually lowered by the requirement to maintain a minimum downstream release of 45 cubic feet per second. The targeted lake elevation by the end of the summer on Labor Day is 5.0 gage or Elevation 586.88 MSL. After Labor Day, a rapid drawdown of the lake to its winter elevation of $3.5^{\pm}$ gage or Elevation 585.38 MSL is made, arriving at that level by mid-October. An attempt is made to hold this winter time level until springtime, when snowmelt inflows once again raise the lake to its summer elevation at the beginning of June.

1.3 Pertinent Data

a. Drainage Area — 95 square miles

b. Discharge at Dam Site

Maximum known flood at dam site:	1,840 cfs in the period since the reconstruction of dam or 1977-1978
Warm water outlet at pool elevations:	NA
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	NA
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	500 cfs, all stop planks in place to Elev. 588.4 & pool at Elev. 589.1
Total spillway capacity at maximum pool elevation:	As above

c. Elevation (Feet above MSL)

Top of dam:	Elev. 592.1
Maximum pool design surcharge:	589.1
Full flood control pool:	NA
Recreation pool:	Elev. 588.4)
Spillway crest:	Elev. 588.4) Flashboards in place
Upstream portal invert diversion tunnel:	NA
Downstream at centerline diversion tunnel:	NA
Streambed at centerline of dam:	Elev. 580
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	6.30 miles (estimated)
Length of recreation pool:	6.16 miles (estimated)
Length of flood control pool:	NA

e. Storage (acre-feet)

Recreation pool:	24,557 AF, Elev. 588.4
Flood control pool:	NA
Design surcharge:	27,715 AF, Elev. 589.1
Top of dam:	41,244 AF

f. Reservoir Surface (acres)

Top of dam:	4,670 A
Maximum pool:	4,410 A
Flood control pool:	NA
Recreation pool:	4,360 A
Spillway crest:	4,360 A

g. Dam

Type:	Masonry and concrete gravity dam with a timber section
Length:	117 feet
Height:	12 feet
Top width:	Varies
Side Slopes - Upstream:	Not applicable
- Downstream:	
Zoning:	
Impervious core:	Not applicable
Cutoff:	Not applicable
Grout curtain:	None

h. Diversion and Regulating Tunnel

Type:	NA
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

Type:	Stop plank sections
Length of weir:	) Total length 43'-6" net on timber dam) plus 13'-0" on new stop plank section) for a total of 56'-6"
Crest elevation:	588.4, stop planks in place
Gates:	None
U.S. Channel:	Newfound River
D/S Channel:	Timber plank and concrete apron, Newfound River

j. Regulating Outlets

Low level outlet:	3 passes, each 6 x 6 feet
Controls:	Timber sluice gates, hoist operated
Emergency gate:	Provisions for stop planks on upstream side
Outlet:	Concrete apron slab

SECTION 2

ENGINEERING DATA

2.1 Design

A partial set of drawings of the dam as modified by the N.H. Water Resources Board (NH-WRB) is available. These drawings show details of the reconstruction completed in 1977 consisting of a triple pass sluice gate section containing three 6 x 6-foot sluice gates and a 14-foot wide stop plank section. These drawings are design drawings and do not have as-built modifications marked on them. No drawings are available for the following dam areas:

(1) The timber dam section on the right abutment.

(2) Details of the right abutment wingwall.

(3) Details of the timber crib foundation as uncovered during the reconstruction of the dam in the period 1975-1977.

(4) Details of the gate access house.

A partial set of design computations relating to the timber sluice gate structural design was recovered from the NH-WRB files. Discharge ratings for the sluice gates and the new stop plank sections have also been computed. No computations were uncovered in the following areas:

(1) Structural design or stability of the timber dam sections.

(2) Stability of the sluice gate or new stop plank sections.

(3) Tailwater rating curves.

(4) Foundation criteria or resistive capacity of the existing timber crib section.

(5) Seepage analysis through the foundation.

2.2 Construction

No detailed engineering information was recovered from NH-WRB files concerning the reconstruction of the dam in the period 1975-1977.

2.3 Operation

Maximum lake level records exist for Newfound Lake from 1937 onward, but with gaps for the years 1948, 1951, 1952, 1956-1960, 1971, and 1975. The maximum lake level recorded in the years of record is 10.1 gage in July 1973 corresponding to Elevation 591.98 MSL. At present, the top of dam is at 10.23 gage or Elevation 592.11. No data is available on the settings of the stop planks or the gate openings at the dam for this high lake level event. Not enough time has passed to accumulate sufficient operating data and experience with the present dam modification.

2.4 Evaluation

a. Availability

The availability of data is fair as far as design is concerned and very deficient as far as construction and operation is concerned. An effort should be made by the owner to assemble more complete documentation.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based

primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity

The available drawings on the reconstructed part of the dam appear to relate closely, in general, with the actual structure. The drawings are not marked "as-built" and should be updated and corrected in line with what was actually built. The as-built condition of the timber foundation uncovered during the reconstruction should be added to the available drawing set.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

Newfound Lake Dam, as reconstructed in the period ending in 1977, is in very good condition and does not show any signs of distress. As a result of the recent repairs and modifications, the operating facilities were all in very good condition.

b. Dam

The dam can be divided into five main parts:

(1) Timber dam section
(2) Sluice gate section
(3) New Stop plank section
(4) Abutment wingwalls
(5) Foundation of the dam

(1) Timber Dam Section. The timber dam section is built adjacent to the right abutment wingwall. The timber dam is built in 6 bays each approximately 7 ft.-3 in. wide. Each bay contains full depth timber stop planks for control of the lake level. The timber framing is massive 12 x 12 beams posts and braces and the entire structure rests on a sloping timber apron. The toe of the timber apron is protected by medium to large sized riprap stones. A timber walkway surmounts the timber dam, permitting access to the stop planks and their convenient operation. The top surfaces of all main timbers are protected by sheet metal covers to shed water and reduce deterioration due to cyclical wetting and drying. All timber parts appear to be sound and all connections visible were securely joined and showed no signs of distress. The timber structure was well aligned vertically and horizontally and showed no signs of lateral movements or deflections.

(2) Sluice Gate Section. The sluice gate section has been rebuilt in 1977 and is situated between two massive masonry piers separating it from the adjacent timber dam and stop plank sections. The masonry piers have been resurfaced with concrete and are in apparent sound condition. No cracking is visible, and the overlay concrete appears soundly attached to the masonry beneath. The sluice sections contains passages for three 6 x 6 foot timber sluice gates separated by 2-foot thick reinforced concrete intermediate piers. The timber gates seal up against a shallow overflow wall with a top elevation at 589.1 MSL, permitting the flow of water over the sluice gates in case the gates are left in the closed position. The pier concrete visible is well aligned and the lift joints are smooth, showing so significant offsets. The concrete surface are new and undeteriorated. The bottom concrete slab of the sluice passages was underwater and could not be inspected in the dry. No downstream channel protection was visible beyond the limits of the apron.

The sluice gates are constructed of timber using corrosion resistant fasteners. The operators, manufactured by Rodney Hunt Inc., are of the rising stem type and provide for two operating speeds, achieved by a combination of 90 degree bevel gearing and spur gearing. The gates can be operated manually by a hand crank placed on either of the two input shafts or they can be operated electrically by a hand held power drill equipped with a special fitting to match the input shafts on the operating mechanism. Electrical power is supplied from an outlet in the gate access house located just to the left of the sluice gates. All three gates and their operating mechanism are in excellent condition.

(3) New Stop Plank Section. The stop plank section has been rebuilt in 1977 replacing a fixed crest concrete overflow weir. The concrete work is new and undeteriorated. This section shares a common foundation slab with the adjacent sluice gate section, which could not be inspected due to high tailwater conditions. The stop plank section

consists of 3 bays, each 4 ft.-8 in. wide. The horizontal planks are supported inside wall resesses and by intermediate steel stanchions The individual timber stop planks are 2 1/2 in. x 7 1/2 in. standard size. They are fitted with eyebolts for handling, and can be conveniently removed and replaced from a concrete walkway above. The stop planks are locked in their grooves to prevent unauthorized removal. The entire stop plank section and components are in excellent physical condition.

(4) Abutment Wingwalls. The left abutment wingwall has been resurfaced with reinforced concrete overlaying an existing cut-stone masonry wall construction. An upstream cutoff has been added, running 6 ft. further into the abutment hillside. All surfaces are excellent.

The right abutment wingwall has also apparently been refaced or rebuilt although no mention of this work exists in the NH-WRB reconstruction drawings. All surfaces are excellent.

(5) Foundation of the Dam.

The dam is allegedly founded on a timber crib and is said to have a timber cutoff. No parts of this foundation system were visible for inspection during the field visit. The general geological setting is as follows:

A terrace, 20-25 feet above the river, occurs east of the left abutment. Terrace material in this deposit is a medium-grained silty, gravelly sand. Gravel sizes average one half inch. Similar material probably occurs in the right abutment terrace 10-12 ft. above the river. Coarse-grained silty gravelly sand is exposed in river bank a few tens of feet downstream of the dam. Gravels were up to 2 in. in size. The abutments and stream section of this dam are probably founded on these recent stream deposits. No seepage was observed in the banks downstream of the dam but some seepage under the dam is likely to occur in this type of foundation material, if not adequately cut off.

c. Appurtenances

A gate access house is located on the massive rebuilt masonry pier between the sluice gate and stop plank sections. It effectively blocks access to the sluice gate operating stands from the main access to the dam on the left abutment. The gate access house contains the electrical power supply source for the portable electric drill which is used to operate the sluice gates. Also located in the access house is a Telemark float gage used to measure the water level upstream of the dam. The gage has a transponder which transmits coded lake level data over a telephone line to the NH-WRB headquarters in Concord.

At present, the gage is not considered to be accurate, due to its location. The dam (and the gage) is located on the river channel approximately 500 feet downstream of the lake outlet. Whenever there is flow in the river channel, there is a difference in elevation between the lake level and the upstream side of the dam. The owners are in the process of installing a length of galvanized pipe from the Telemark gage float well to the lake itself. In this way, the float will register the actual level of the lake rather than the level of the river at the dam.

There is a staff gage affixed to the abutment of a bridge crossing the channel of the Newfound River just at the outlet of the lake. This gage has its datum at Elevation 581.88 and indicates the correct level of Newfound Lake. The discharge at the dam is determined by observation of a tailwater staff gage affixed to the left channel bank approximately 150 ft. below the dam. Gage readings have been correlated to discharges up to 2,180 cfs. The sluice gates are operated until the desired tailwater depth is achieved consistent with the targeted discharge.

d. Reservoir

The reservoir rim is generally flat to moderately sloping for the first 5 to 6 feet above the full lake level and moderately sloping above that. The lake rim is naturally wooded, with local clearings where summer cottages or residences have been constructed. No signs of reservoir rim instability could be visually detected. The dam is located along the river channel, some 500 feet downstream of the lake outlet. The upstream channel is well defined and unobstructed. Riprap protection has been provided on the right river bank upstream of the abutment wingwall. This riprap is in good condition.

e. Downstream Channel

The downstream channel is well defined, unobstructed and at a moderately steep hydraulic slope. The stream banks are 6 to 8-foot high immediately downstream of the dam and have slopes of 1 on 2 horizontal. Riprap placed along the right channel side downstream of the dam is in good condition and the riprap protection on the downstream left bank is in acceptable condition. There is a power generating dam downstream of Newfound Lake Dam in current use.

3.2 Evaluation

The overall physical condition of the dam is very good, due to its recent renovation. No conditions were uncovered during the visual phase that require further examination and review except for periodic inspection of the concrete apron downstream of the sluice gate and new stop plank sections.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Newfound Lake Dam is operated under tight lake level surveillance and control by the N.H. Water Resources Board (NH-WRB). Lake levels are automatically read at the dam site and telephonically monitored in NH-WRB headquarters in Concord. The dam is visited twice a week by a dam operator for the WRB to adjust the sluice gate openings to meet targeted lake levels. Additional visits are made, if required by unusual circumstances. Lake release discharges are determined by WRB engineers based on targeted lake levels and lake inflows. A minimum discharge of 45 cfs is maintained in the Newfound River at all times. The lake levels are seasonally adjusted as described in Section 1.2.i. above. Required discharges are met by the dam operator by observation of a tailwater gage which has been calibrated against discharges up to 2,180 cfs. Changes in discharges at Newfound Lake Dam are communicated to the operators of a power dam owned by the International Packing Corporation in the river reach downstream of the dam.

4.2 Maintenance of Dam

Maintenance of the dam is on an as-needed basis, based on the reports by the dam operators. Because of the newness of the reconstructed facility, no scheduled maintenance is being carried out.

4.3 Maintenance of Operating Facilities

The sluice gate hoist mechanisms are maintained in connection with the periodic visits to the dam site on an as-needed basis.

4.4 Description of any Warning System in Effect

The dam operators at the downstream power dam are notified by the NH-WRB dam operator when river discharges at Newfound Lake Dam are changed.

4.5 Evaluation

Operational procedures are considered adequate in line with the degree of lake level control being exercised. A formal bi-annual inspection should be initiated utilizing the format of the Corps of Engineers check list. These inspection reports should be kept on file. Logs should be kept of the operation and maintenance of the sluice gates and stop planks. Records should be kept of water levels in the lake and in the stream during unusual storm events and pond dewaterings.

The downstream aprons should be dewatered at a convenient time and inspected at 10-year intervals.

Even though the dam is normally unattended, it would be desirable to establish some sort of communication channels to the downstream community of Bristol, to alert it to the possibility of impending high stream stages in case of dam accident or failure.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of the Newfound Lake Dam was based on criteria set forth in the Corps' Guidelines for Phase I inspections, and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Flood (PMF) was estimated from guide curves for probable maximum flood for New England region, based on past Corps' studies. The PMF peak versus drainage area curves are presented in the section of hydrologic computations.

The PMF curve applicable for rolling areas was adopted for the estimation of PMF peak of the Newfound Lake Dam watershed. The PMF versus drainage area relationship can be expressed mathematically as follows:

$$Q = 2323 - 676.99 \log_{10} A$$

$$Qp = Q \times A$$

where

Q = Unit peak discharge in cfs/square miles

Qp = Peak PMF discharge, in cfs, for the watershed

A = Watershed area, in square miles, upstream of the dam axis

The computed peak discharge of PMF for a drainage area of 95 square miles using the above equation is 93,500 cfs. A triangular shaped flood hydrograph was assumed for the inflow design hydrograph.

The PMF inflow hydrograph was routed through the reservoir by the modified Puls Method, utilizing computer program HEC-1. The peak outflow discharges for the PMF is 16,161 cfs, and results in overtopping of the dam.

The reservoir stage-capacity curve was constructed using comparisons of both dam inventory data and planimetered areas, measured from 15 minute quadrangle topography maps. Reservoir storage capacity included surcharge levels exceeding the top of the dam and assumed that the dam remains intact during routing. In the routing computations, the assumption was made that the stop planks are in place up to the normal summertime lake level Elevation 588.4 (lake gage 6.5) and that the three 6 x 6 foot sluice gate openings are fully open.

Since the spillway of the dam is incapable of passing the PMF without overtopping the dam, an assessment of downstream hazards due to a flood wave that would result with dam failure was also estimated. The magnitude of the flood wave was estimated using generally accepted "rule of thumb" computational procedures established by the New England Division of the Corps of Engineers, in combination with sound hydrologic engineering judgement.

Computations relating to the flood routing of the dam break hydrograph for downstream areas are given in the section on hydrologic computations. The result of this computation shows that in the event of a hypothetical dam failure at the time the lake level is at the top of dam, a lake discharge of about 9,250 cfs would be released. Flood stages in the downstream channel reaches are given in the following table:

TABLE 1

Distance Downstream of Dam Axis (Miles)	Est. Flood Stage (Feet)
0.04	9.0
1.0	8.2
2.0 (Bristol)	9.6

The flood stages would affect the structural stability of those buildings in the downstream reach, whose foundations are below the hypothetical inundation level, and could cause large scale property damage and possible loss of lives.

b. Experience Data

A summary record of the maximum annual reservoir stage is available for this site, which shows that the dam has not been overtopped since 1937, although it did come within one inch and a half of doing so during 1973. The modifications made to the sluice gate passages and the addition of the new stop plank section should reduce the overtopping hazard somewhat.

c. Visual Observations

The river channel upstream of the dam is shallow and rapidly flowing. The lake appears to be very much deeper. A considerable amount of the lake storage is inactive. The maximum drawdown possible is not determinable without a detailed survey of the stream channel at the lake outlet.

d. Overtopping Potential

As indicated in Section 5.1.a., the PMF, when routed through Newfound Lake Reservoir, results in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flow. The PMF

would overtop the dam by 12.7 feet. The spillway is only capable of passing a flood equal to approximately 19 percent of the PMF without overtopping the dam. Since PMF is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Inspection of Dams by the Corps, the spillway capacity of the Newfound Lake Dam is considered seriously inadequate. The basic data employed in the evaluation of the hydraulics of the channel reaches upstream and downstream of the dam for this Phase I Study are very preliminary in nature and contain uncertainties as to the relationships between concurrent water levels at the main part of the lake and at the dam. The discharge over the dam during storm events of PMF magnitude may also be affected by the general submergence of the dam although the preliminary evaluation of this effect indicates that it is not likely to be significant. It is recommended that further studies be made by the owner to further refine the hydraulic characteristics of the channel reaches upstream and downstream of the dam based on more definitive data to be acquired.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no signs of structural instability apparent on visual examination. No leakage or seepage was observed at the abutments or at the toe of the dam where not obscured by water overflowing the various sections of the dam. The dam appeared to be in good alignment and no settlement could be detected. There were no noticeable cracks or excessive deflections to indicate overstressed conditions. On the basis of the visual examination and the dam's 138-year service history, structural stability under present conditions is not of great concern because of the dam's low height and relatively substantial width as related to its height.

b. Design and Construction Data

Insufficient documentation has been recovered to assess the structural stability of the dam. No cross sections of the timber dam are available and the depth to the foundation crib is not defined. No data is available on the dimensions and properties of the foundation timber crib on which the dam is apparently founded. There is no pertinent construction data on which an evaluation of structural stability can be founded.

c. Operating Records

High water records documented since 1937 indicate that the dam has apparently not suffered damage at lake levels rising to within one and one half inches of overtopping the structure. Not enough time has elapsed since the 1977 dam modifications to assess the stability of the modified structure under severe hydraulic loadings.

d. Post Construction Changes

The modifications completed in 1977 are believed to enhance the stability of the dam. The new base slab underlying the sluice gate and new stop plank sections are tied into the massive piers and a long left abutment wingwall. The weight of these structural components are mobilized for stability and the new slab spreads any imbalances to the timber crib foundation below. The reinforced concrete overlays covering the masonry piers and left abutment wingwall are useful in stabilizing the structural integrity of these components.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The overall physical condition of Newfound Lake Dam is good as a result of the modifications completed in 1977. The dam has a seriously inadequate spillway capacity, capable of passing only 19 percent of the Spillway Design Flood (SDF) without overtopping of the dam. Overtopping of the dam carries with it the risk of undermining parts of the dam, possibly leading to progressive failure. The spillway discharge capacity has been estimated by current Corps of Engineers screening criteria, and the owner should determine the spillway capacity by more sophisticated and accurate methods and procedures.

b. Adequacy of Information

Even though there is a lack of plans, sections and details of the timber dam portion and a similar lack of information concerning the foundation timber crib, an adequate assessment of the dam consistent within the scope of a Phase I investigation is possible based upon the visual inspection and available information.

c. Urgency

The urgency of performing the recommendations and remedial measures are detailed below.

d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

7.2 Recommendations

It is recommended that the owner, within 24 months after the receipt of this Phase I Report, assemble the following:

a. Data Acquisition

(1) An updated as-built set of drawings of the dam showing all pertinent details and correcting information gaps on the presently available drawings.

(2) The details of the timber crib dam should be added to the set from an as-built survey of the dam to the extent determinable.

(3) Properties and details of the underlying timber crib foundation uncovered during the modifications completed in 1977 should be added to the record set.

(4) A topographic survey of the channel and overbank area upstream of the dam should be undertaken and channel cross section taken at reasonable intervals to determine the maximum lake level drawdown possible.

(5) The character of the channel bottom should be investigated in detail to determine its erodibility in the event of a hypothetical dam failure.

b. Investigations

Determine and document the spillway capacity of the dam using more sophisticated and accurate methods than were used in the Phase I screening methodology employed in this report, including the routing of the inflow through the lake. A tailwater rating curve should be computed for very large discharge volumes, extending the range of the present curve.

Based on the results of the spillway capacity analyses, the owner should formulate plans for augmenting the spillway capacity if shown necessary.

7.3 Remedial Measures

a. Alternatives

The alternatives available for augmenting the spillway capacity of the dam are:

(1) Raising the non-overflow parts of the dam to permit greater heads and discharges over and through the existing facilities.

(2) Provision of additional spillway capacity at the left abutment by a fixed weir and culvert structure under the present access road.

(3) Addition of spillway capacity along the right abutment either in the open or in a culvert to minimize the effect on the existing structure on the abutment.

(4) Seasonal regulation of the lake levels to provide additional storage capacity in anticipation of large runoff events.

(5) A combination of the above methods.

b. O&M Maintenance and Procedures

The owner should initiate the following programs:

(1) An bi-annual inspection of the dam utilizing a visual check list similar to that used in this inspection report.

(2) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance. Dewater the downstream apron area at 10-year intervals, and inspect for scour and channel degradation and undercutting.

(3) Assemble and keep on hand complete documentation of the dam design, as-built drawings, and any other data pertaining to the dam safety.

(4) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

APPENDIX A

CHECK LISTS:
- VISUAL OBSERVATIONS
- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam NEWFOUND LAKE DAM County Grafton State New Hampshire Coordinators

Date(s) Inspection June 5, 1978 Weather Light Rain Temperature 65°F

Pool Elevation at Time of Inspection 588.9 M.S.L. Tailwater at Time of Inspection 581.8 M.S.L.

Inspection Personnel:

Seymour Roth
David Kerkes
Yin Au-Yeung
Recorder: Seymour M. Roth

Lynn Brown
Eilliam Flynn

Representing the N.H. Water Resources Board, Owner of the Dam:
Mr. Lyall Milligan, Dam Operator

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None observed at either abutment.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	The junction of the dam to the abutments is in the form of concrete wingwalls perpendicular to the dam axis. On the left abutment, a cutoff wall 8-foot long ties into higher ground. The access road level on this side is approximately 3 feet above the dam top. On the right abutment, the ground is lower and could be used as an auxiliary spillway.	
DRAINS	None installed.	
WATER PASSAGES	Three 6-foot wide open sluice gate passages are installed in the center of the dam controlled by wooden sluice gates and hoists. Three stop plank passages each 4 ft-8 in. wide are installed adjacent to the left abutment. A concrete walkway has been provided over the sluice gate and stop plank sections of the dam for access and operation.	
FOUNDATIONS	Timber crib foundation and wood cutoff according to plans could not be visually inspected or verified due to head and tailwater levels prevailing.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	All concrete surfaces are in good to excellent condition, with little or no surface deterioration due to weathering or water caused erosion.	
STRUCTURAL CRACKING	None observed.	
VERTICAL & HORIZONTAL ALIGNMENT	All alignments seemed good on visual inspection.	
MONOLITH JOINTS	None observed.	
CONSTRUCTION JOINTS	No visible offsets or misalignments were observed at construction joints.	

TIMBER DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDAIONS
GENERAL CONDITION	The timber dam on the right abutment seemed in good serviceable condition. Main brace timbers are in sound condition and have top surfaces protected by sheet metal against excessive wetting. Timber dam has 6 8-foot wide bays each accommodating 2 stop plank passes.	No action required.
FOUNDATION	The foundation is apparently a timber crib. The floor of the timber dam section is timber and is continuously wetted. Timber condition appeared good. Cutoff and crib timber not visible.	No action required.
STOP PLANKS	All stop planks were in place and appeared to be in sound condition. Some stop planks are not tightly butted against each other permitting leakage between sections.	No action required.
DISCHARGE CHANNEL & TOE PROTECTION	Irregularly placed stones at toe of timber dam section.	
BRIDGE	A wooden walkway over the timber dam section connects the right abutment to the adjacent sluice gate section.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Not applicable	
ANY NOTICEABLE SEEPAGE	Not applicable	
STAFF GAGE AND RECORDER	Not applicable	
DRAINS	Not applicable	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	All concrete surfaces are in excellent to good condition, showing little or no surface deterioration and no significant cracking.	
INTAKE STRUCTURE	Not applicable.	
OUTLET STRUCTURE	See comments under "Water Passages - Concrete Masonry Dam".	
OUTLET CHANNEL	The outlet channel downstream of the stop plank and sluice gate parts of the dam are protected by a concrete slab extending about 12 feet downstream of the end of the sluice gate piers; condition of the slab not determinable due to tailwater.	Inspect downstream apron slab at 10-year intervals.
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Not applicable	
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE AND PIERS	Not applicable	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL	Not applicable	
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE AND PIERS	Not applicable	
GATES & OPERATION EQUIPMENT	Not applicable	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHERS	The dam has a lake gage mounted on the right abutment of the bridge over the head of the outlet channel. Gage zero is at Elevation 581.88 MSL and full lake is 7.23 gage. A Telemark recorder automatically records the lake level at the dam and transmits data over a telephone line to N.H. Water Resources Board offices at Concord. A tail-water staff gage in the downstream channel is used to determine discharges over and through the dam and regulate the discharge at the dam.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENTATIONS
SLOPES	The reservoir rim slopes are very mild to about levation 595, or 5 to 6 feet above normal lake level and moderately sloping after that level.	
SEDIMENTATION	No sedimentation is noticeable in the channel of the Newfound River between the main body of the lake and the dam.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is well defined and unobstructed.	
SLOPES	The side slopes of the downstream channel are about 1 on 2 horizontal and the channel is about 6 to 8-foot deep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There is one residence on the right abutment immediately downstream of the channel. A power dam is located approx. 3/4 mile downstream of the dam axis. The population center of Bristol is approximately 2 1/4 miles downstream, with parts of town as close as 1.5miles below the dam. The population of Bristol is estimated at 1,000.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Partial plan of 1977 reconstruction available. The timber dam section does not have a usable plan.
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Not available in records of N.H. Water Resources Board.
TYPICAL SECTIONS OF DAM	Available for 1977 reconstruction.
HYDROLOGIC/HYDRAULIC DATA	Rating curve for stop plank section available. Rating curve for 6 x 6 sluices not uncovered. Lake level record available.
OUTLETS - PLAN	)
- DETAILS	) Available for 1977 reconstruction
- CONSTRAINTS	) None discovered
- DISCHARGE RATINGS	Available for stop plank section
RAINFALL / RESERVOIR RECORDS	Reservoir records concerning maximum annual lake level available from 1937 onward with several gaps in the record.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None uncovered
GEOLOGY REPORTS	None uncovered
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS	Structural computation for sluice gate design, minor parts of the stop plank section and cuoff wall are available.
DAM STABILITY SEEPAGE STUDIES	No stability or seepage studies uncovered.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None uncovered
POST-CONSTRUCTION SURVEYS OF DAM	None uncovered
BORROW SOURCES	Not applicable
SPILLWAY PLAN - SECTIONS - DETAILS	Drawings details of the 1977 reconstruction available. No drawings of the timber dam section or foundation are available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Details of the sluice gates and stop plank section are available.
MONITORING SYSTEMS	Automatic lake level recorder and coded telephonic signal transmission to N.H. Water Resources Board headquarters, in Concord, N.H.
MODIFICATIONS	Dam rebuilt in 1977. New sluice gates section and stop plank section added.
HIGH POOL RECORDS	Available from 1937 onwards, but with significant gaps in the records.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None uncovered
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None uncovered
MAINTENANCE OPERATION RECORDS	None uncovered

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: NEWFOUND LAKE DAM

Drainage Area Characteristics: 95 square miles

Elevation Top Normal Pool (Storage Capacity): 588.4 (24,557 AF)

Elevation Top Flood Control Pool (Storage Capacity): NA

Elevation Maximum Design Pool: 589.1

Elevation Top Dam: 592.1

SPILLWAY CREST:

a. Elevation 588.4
b. Type Stop log sections
c. Width 2 1/2 inches (stop planks)
d. Length 56 ft.-6 in. in two sections
e. Location Spillover 43 ft.-6 in. on right abutment, 13 ft.-0 in. on left abutment
f. No. and Type of Gates None

OUTLET WORK:

a. Type Three 6 x 6 ft. sluice gates, timber construction
b. Location Center of dam
c. Entrance Inverts 581.1
d. Exit Inverts 581.4
e. Emergency Draindown Facilities Sluices are used for this purpose

HYDROMETEOROLOGICAL GAGES:

a. Type Staff gage channel
b. Location At exit of Newfound Lake
c. Records Forwarded to U.S.G.S.

MAXIMUM NON-DAMAGING DISCHARGE 1,700 cfs (estimated)

APPENDIX B

PHOTOGRAPHS

All Photographs taken on June 5, 1978

Photo 1 - Detailed view of the timber dam at the right abutment from downstream.

Photo 2 - View of the 6 ft. x 6 ft. sluice gate passage, gate access house and the new stop plank section on left abutment of the dam looking from downstream.

Photo 3 - View of the sluice gate section, the gate access house and the new stop plank section from upstream.

Photo 4 - View of the timber dam section and the right abutment from the upstream side.

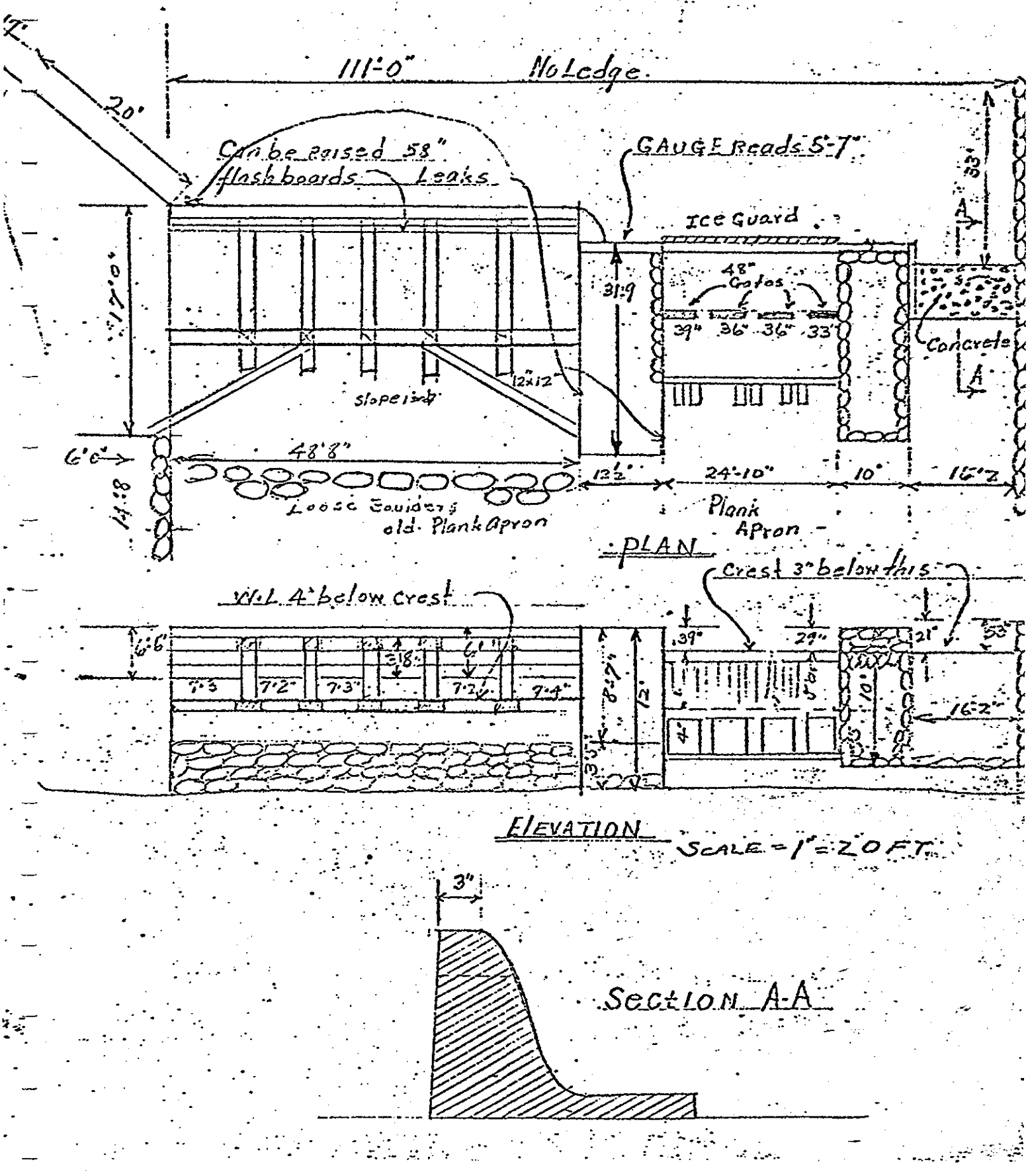
Photo 5 - View of the approach channel of Newfound River from the dam. The dam is located approximately 500 ft. downstream of the natural outlet of Newfound Lake. Note the sluice gate hoist stand in the foreground.

Photo 6 - View of the downstream channel of Newfound River taken from the dam.

APPENDIX C

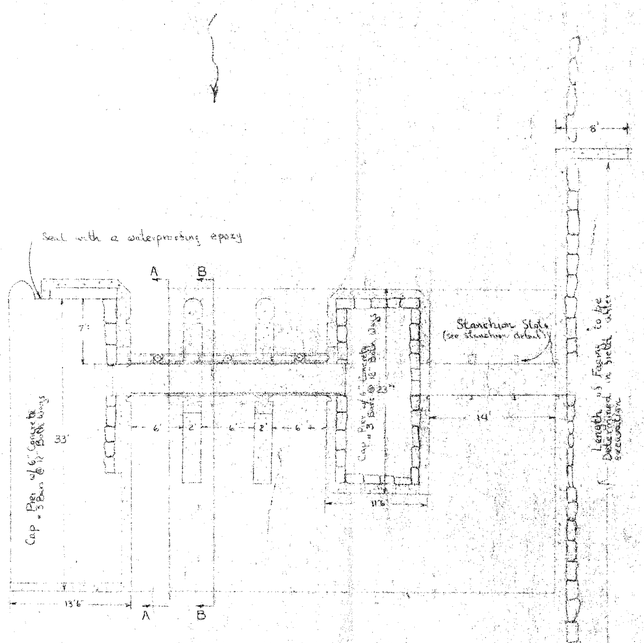
PLATES

PLANS AND DETAILS OF DAM	Drawings 1,2,3,4 & 5
GEOLOGICAL MAP	Drawing 6



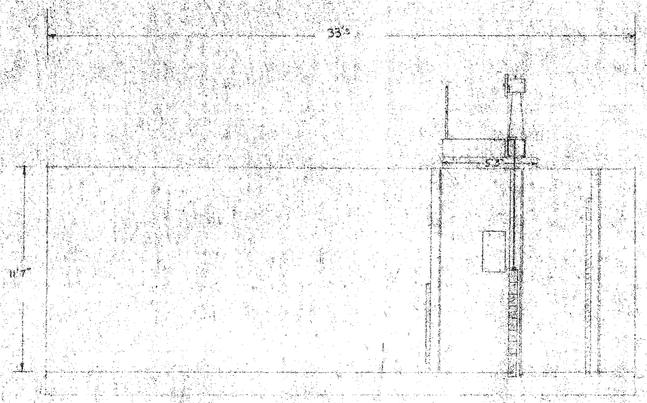
HARRIS-ECI ASSOCIATES

NEWFOUND LAKE - LAKE OUTLET - DWG. 1

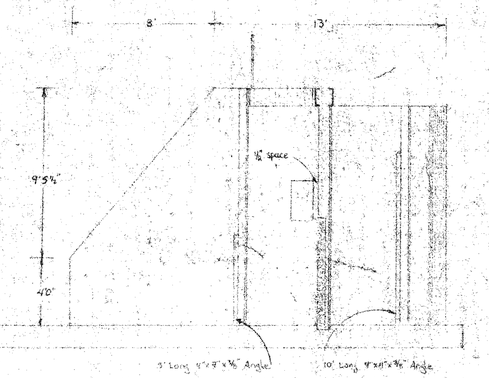


Plan
Scale : 1/8" = 1'0"

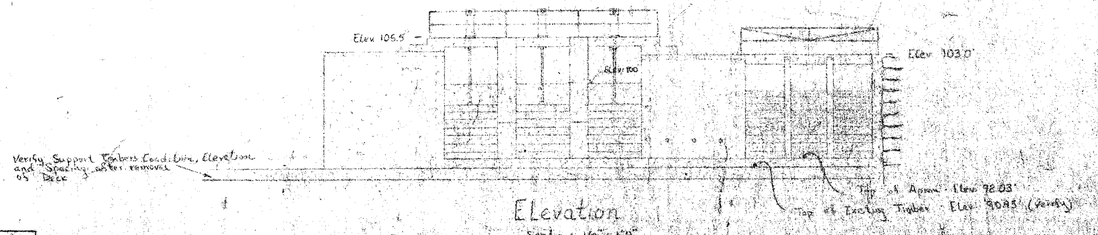
Backfill around outlet wall with impervious material



Section A-A
Scale : 1/4" = 1'0"



Section B-B
Scale : 1/4" = 1'0"



Elevation
Scale : 1/8" = 1'0"

REVISIONS

DATE

Designed by J. J. Dimon 12/19/72
Drawn by J. J. Dimon 12/19/72
Traced by
Checked by

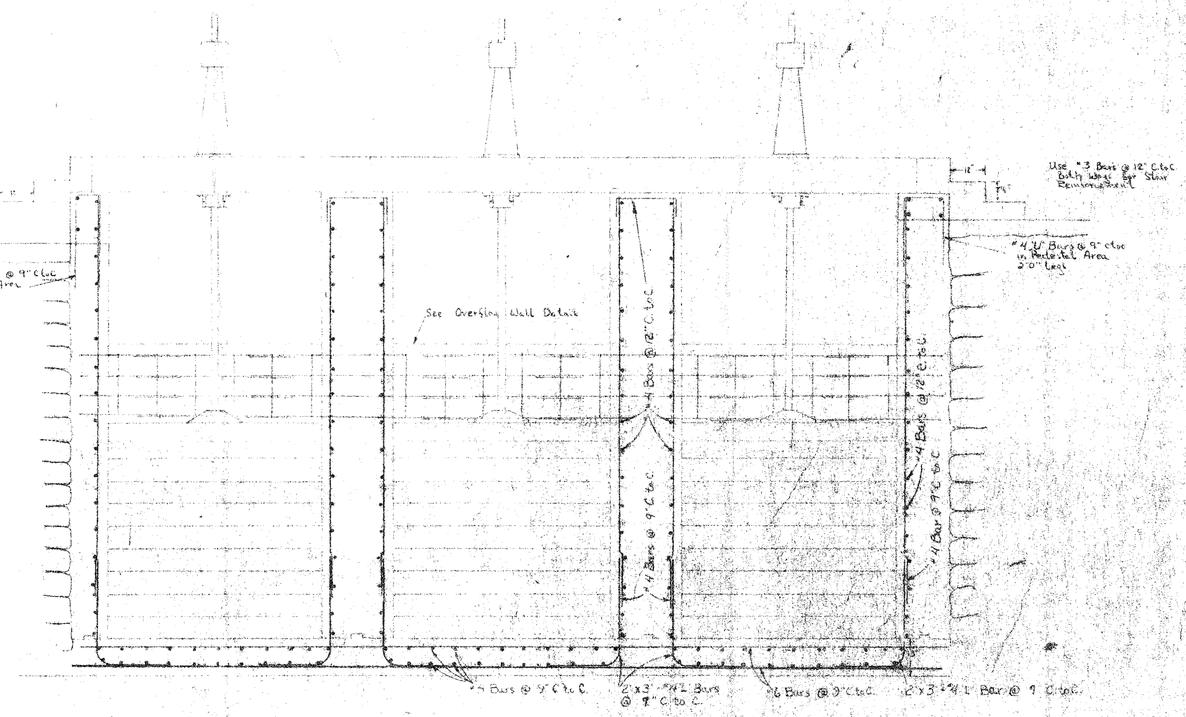
DWG. NO. 2

Newfound Lake

NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N.H. -

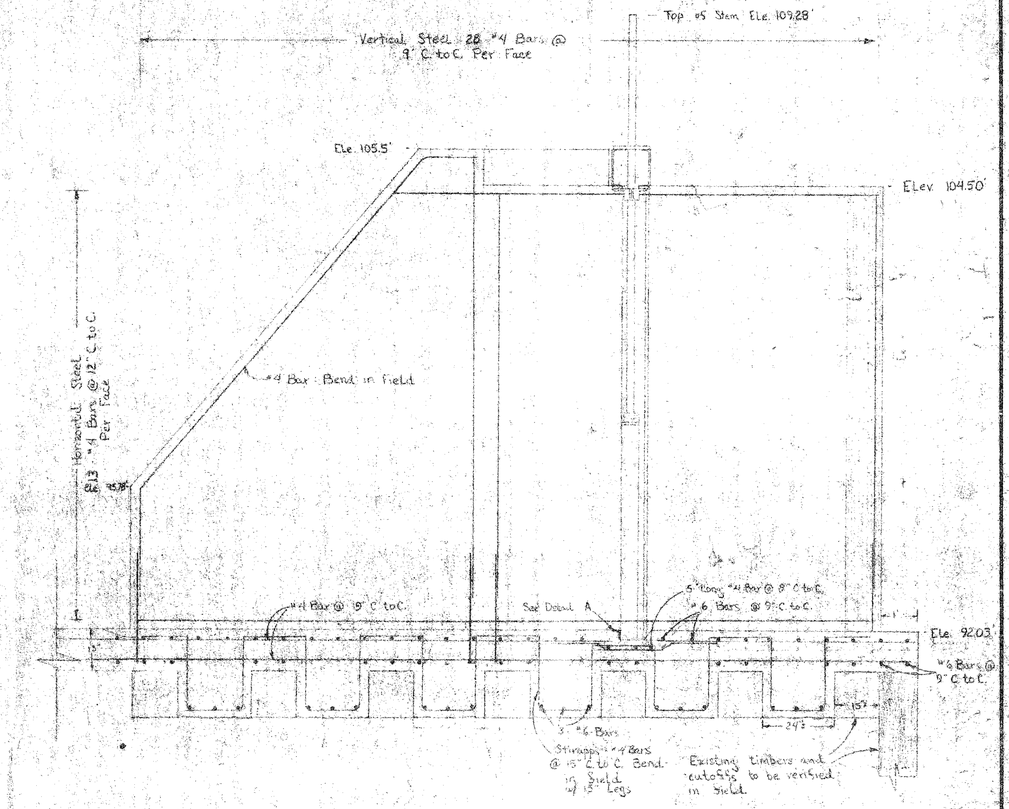
*31.01

1 of 6



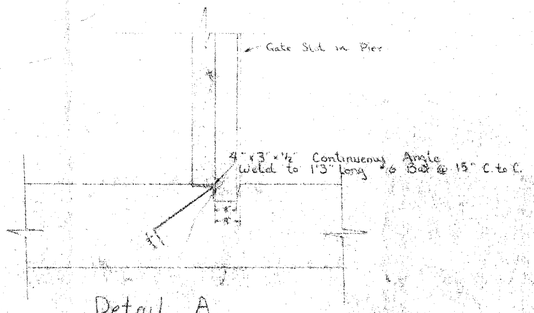
Gate Section

Scale : 1/2" = 1'0"



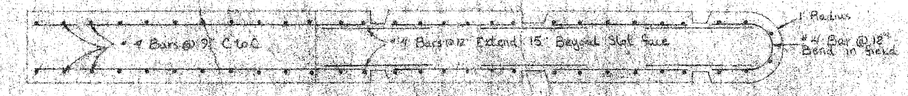
Reinforcing Steel for Pier

Scale : 1/4" = 1'0"



Detail A

Scale : 1" = 1'0"



PIER PLAN

Scale : 1/2" = 1'0"

REVISIONS

DATE

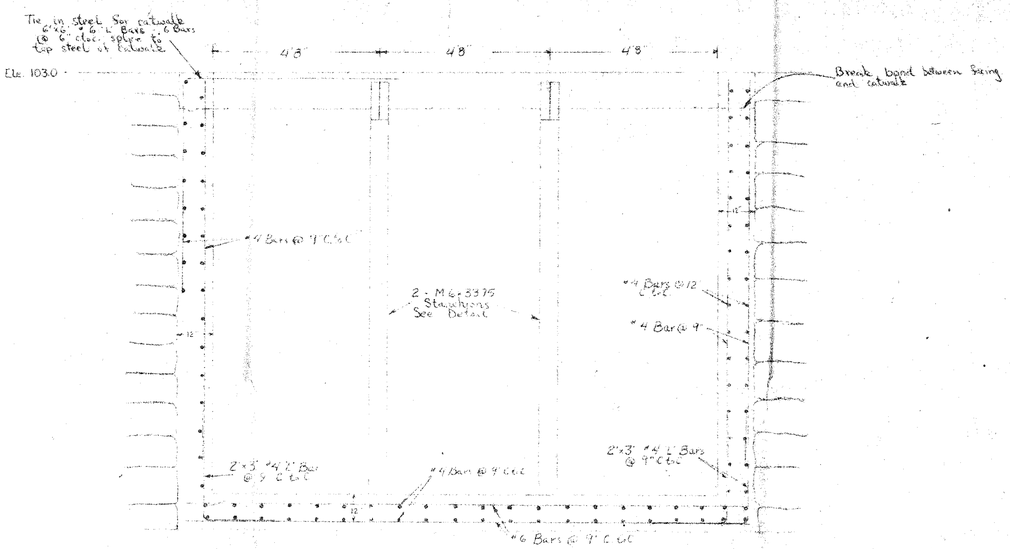
Designed by R.J. Dumas 12/19/05
Drawn by R.J. Dumas 12/19/05
Traced by
Checked by

DWG. NO. 3

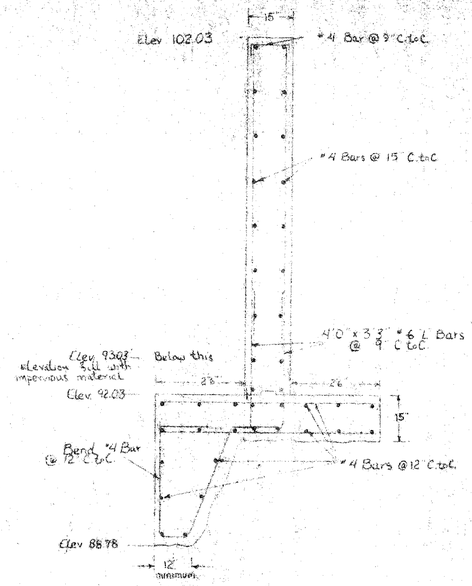
Newfound Lake

NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N. H. -

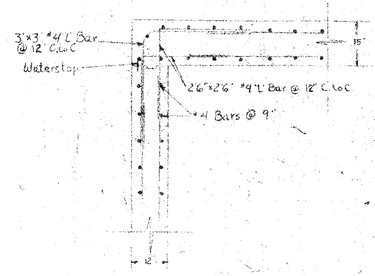
3101 | 2 of 6



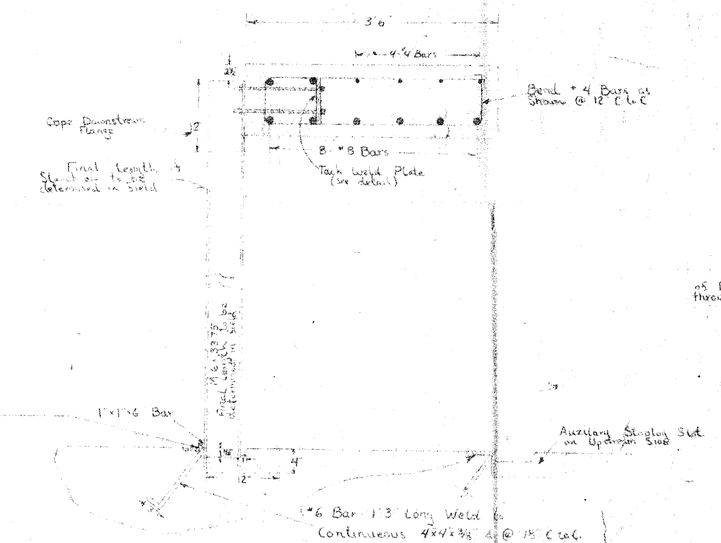
Stoplog Section
Scale: ½" = 1'0"



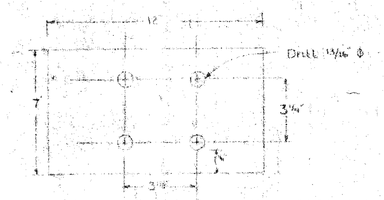
Cutoff Wall Detail
Scale: ½" = 1'0"

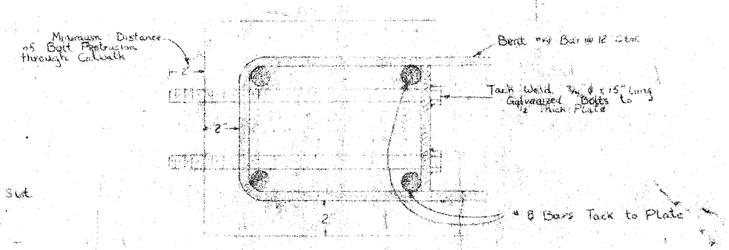


Cutoff to Facing Tie-in
Scale: ½" = 1'0"

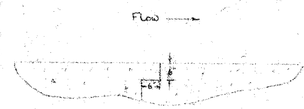


Stanchion & Catwalk Detail
Scale: 1" = 1'0"





Stanchion Support Plate Detail
Scale: 3" = 1'0"



Keyed Floor Joint
Scale: 1½" = 1'0"

REVISIONS

DATE

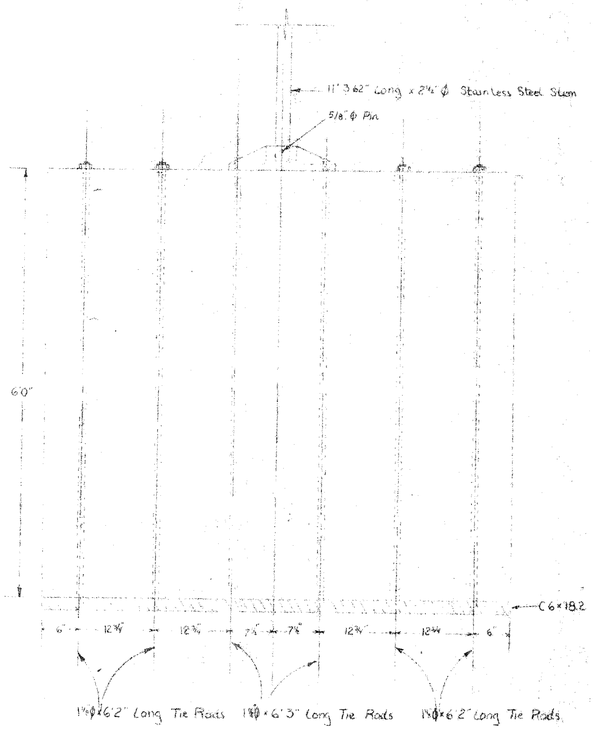
Designed by Z.J. Daniels 12/19/75
Drawn by Z.J. Daniels 12/19/75
Traced by
Checked by

DWG. NO. 4

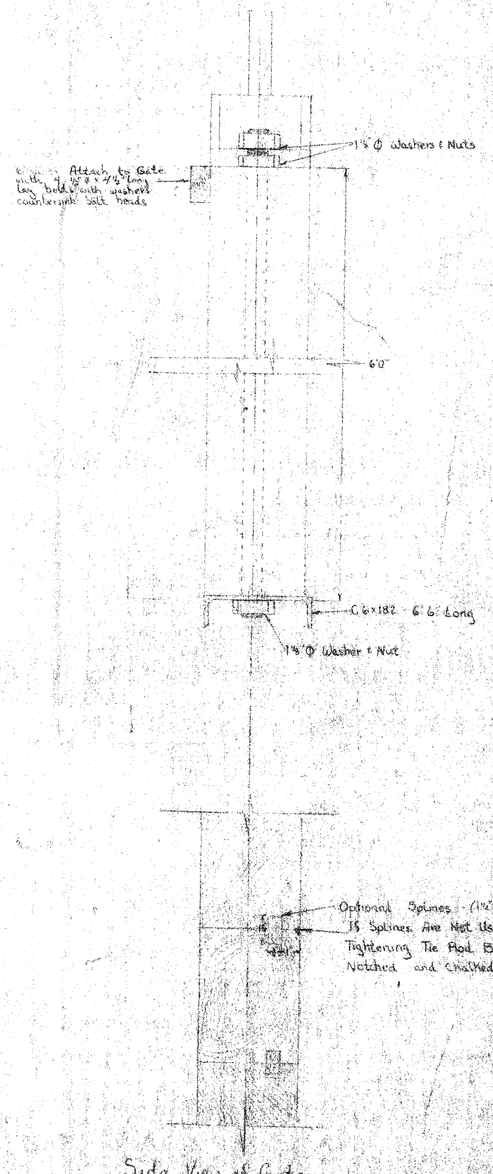
Newfound Lake

NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N. H. -

"31.01" | 4 of 6



Front View of Gate
Scale 1"=1'0"



Side View of Gate
Scale 3"=1'0"

Notes:

1. Design based on sound foundation material. Should poor material be encountered then slab design may have to be altered.
2. Verify following in field
   (a) All elevations
   (b) Type and condition of foundation material including support timbers
   (c) Number, type, depth and condition of existing cutoffs
   (d) Condition of stone retaining wall nearest road
3. All cutoffs to be continuous ie if any are damaged then they should be repaired
4. If no cutoffs exist then install two cutoffs shown in cutoff wall detail at upstream and downstream ends of apron
5. All elevations are based on Full Lake = 100.0' or 723 on Lake gage or 9.0' on dam gage
6. Concrete & Steel Specs
   f'_c = 3000 psi air entrained for piers, facings, walls and slab
   f'_c = 4000 psi air entrained for catwalks
   3" maximum slump
   S_s = 20,000 psi ; all splices to be a minimum of 24 bar diameters
   All steel will have a 3" concrete cover - except where noted
7. Chamfer all concrete edges
8. All joints will be provided with waterstops except where noted
9. Concrete bond at catwalk supports will be broken using construction paper.
10. Cure concrete a minimum of 3 days from pour
12. Cutoff wall will be backfilled in 12" layers and compacted with good clean material. Backfilling should be done in alternating layers with respect to wall. Sheet so as not to overload wall.
13. The cutoff wall should not be subjected to extreme surcharge loadings during construction.
14. Provide weep holes 2½" in diameter at 4'0" C. to C. at an elevation of 94.0'
15. Place construction joints at 30'0" c. to c.
16. Locate steel guard rails in field
17. All bolt holes will be drilled 1/16 larger than bolt diameter in channels etc.
18. Dowels will be grouted in using a non-shrink cement
19. Supply as built plans

DWG. NO. 5

Newfound Lake

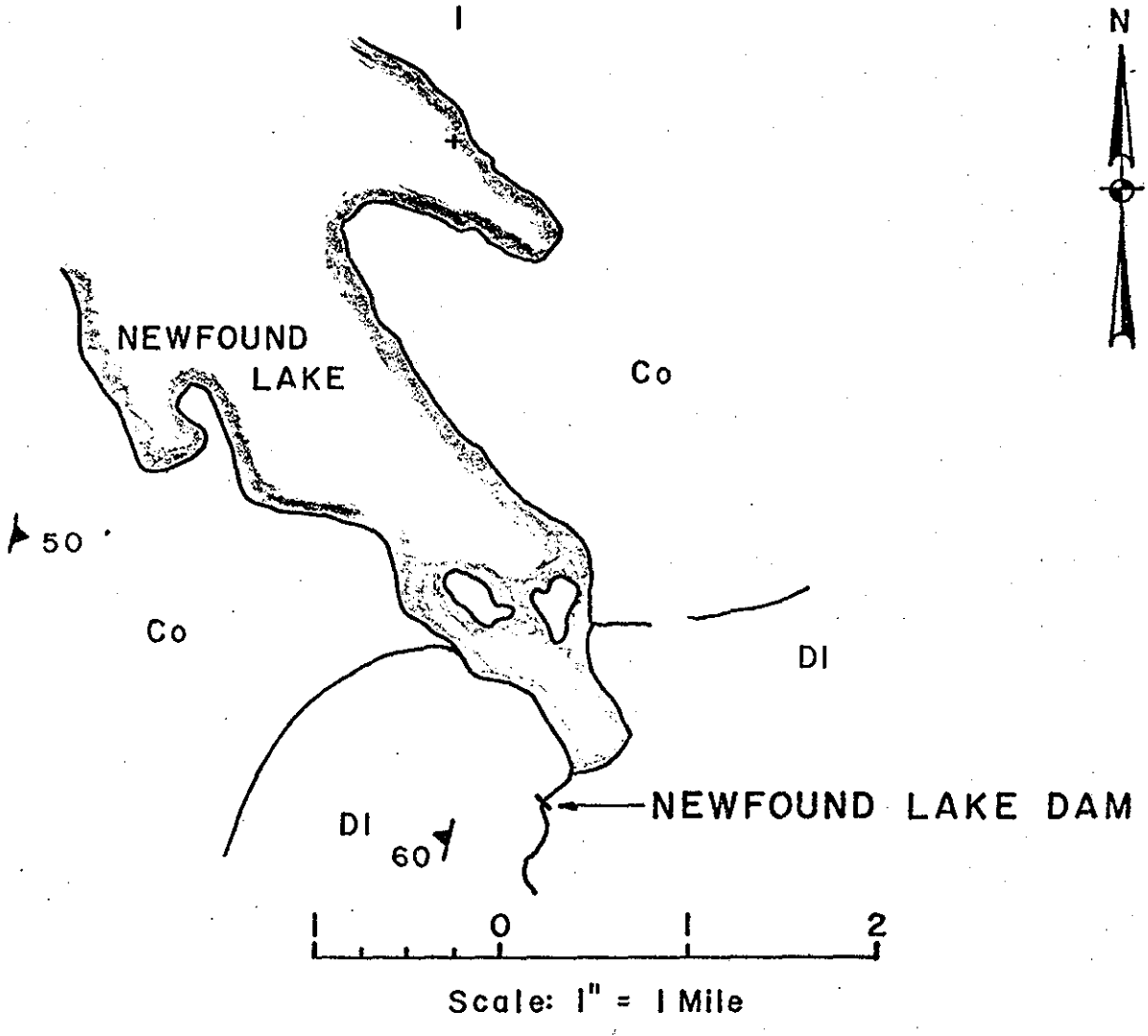
NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N. H. -

# 31.01		6 of 6

REVISIONS

DATE

Designed by R.J. Dumas 12/15/72
Drawn by R.J. Dumas 12/15/72
Traced by
Checked by



Scale: 1" = 1 Mile

LEGEND:

Co	Granite, Fine- to Coarse-Grained
DI	Quartz-Garnet-Mica Schist
60	Strike and Dip of Foliation
———	Contact

NOTES:
1. Ground Moraine Mantles Bedrock Near the Dam
2. Silty Gravelly Sand Occurs Along Stream Banks as Terrace Deposits from Glacial Outwash or Recent Stream Action

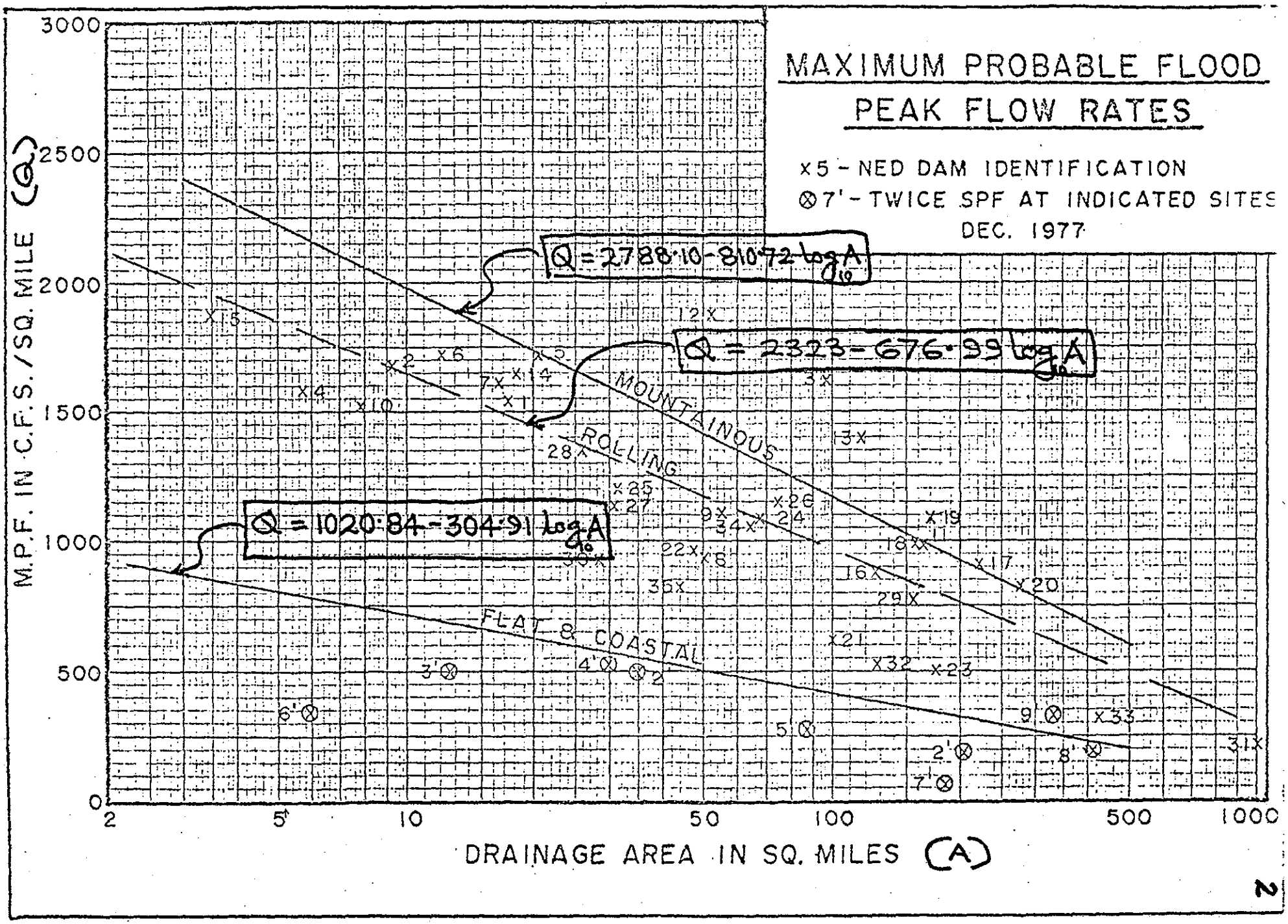
GEOLOGIC MAP
NEWFOUND DAM

DWG. NO. 6

APPENDIX D

HYDROLOGIC COMPUTATIONS

NEWFOUND LAKE DAM
DRAINAGE BASIN


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SITES
DEC. 1977
Q = 2788·10 - 810·72 log A
Q = 2323 - 676·99 log A
Q = 1020·84 - 304·91 log A
MOUNTAINOUS
ROLLING
FLAT & COASTAL
M.P.F. IN C.F.S./SQ. MILE (Q)
DRAINAGE AREA IN SQ. MILES (A)
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500
1000

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION — SHEET NO. 1 OF
NEW FOUND LAKE DAM — JOB NO. 1211-001-1
PMF HYDROGRAPH — BY KLB DATE 7-31-7

MAXIMUM PROBABLE FLOOD PEAK FLOW RATE

ACCORDING TO NED GENERAL CURVE

ASSUME FOLLING AREA

$A = 95$ SQ. MI.

$Q = 2323 - 676.99 \log_{10} A$

$Q = 984$ CFS/SQ. MI

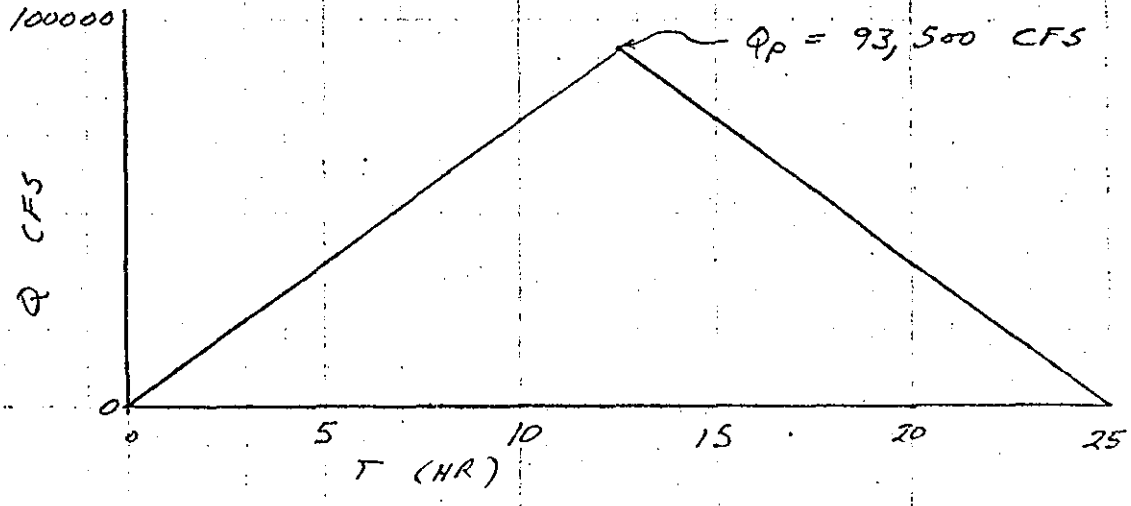
$Q_p = A \times Q = 95 \times 984 \approx \underline{93,500}$ CFS

SINCE PMF RUNOFF IN NEW ENGLAND EQUALS ABOUT 19 INCHES ACCORDING TO NED GUIDELINES

THE TRIANGULAR SHAPED HYDROGRAPH WILL BE APPROXIMATED BY THE FOLLOWING SHAPE

VOLUME $= 19'' \times A = \frac{1}{2} T_b \times Q_p$

$\therefore T_b = 2[(\frac{19}{12}) \times 95 \times (5280)^2] / [3600 \times 93500] \approx 25$ HR



$L_1 = 18'$; $L_2 = 43.5'$; $L_3 = 13'$; $L_4 = 43.5'$; $L_5 = 62.0'$; $L_6 = 4'$;

$L_7 = 1'$; $L_8 = 22'$

FOR ORIFICE FLOW

$A_1 = 3 \times 6 \times 6 = 108$ SQ FT. $\quad A_3 = 13 \times 2.7 = 35.10$ SQ FT.

$A_2 = 6 \times 7.25 \times 0.4 = 17.4$ SQ FT $\quad A_4 = 6 \times 7.25 \times 0.8 = 34.80$ SQ FT.

EQUATION:

ORIFICE FLOW $\quad Q = 0.6 A \sqrt{2gH}$

WEIR FLOW $\quad Q = CLH^{3/2}$

HJB

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 3 OF 5

NEWFOUND LAKE DAM JOB NO. 121-001

SPILLWAY & OVERTOP RATING CURVE BY MAS DATE

ELEV FEET	HEAD ON SPILLWAY CREST, FT	H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8	Q
606.1	17.7	17.7	17.7	17.7	15.8	14	14	13	11.5	18728
611.1	22.7	22.7	22.7	22.7	20.8	19	19	18	16.5	23216
616.1	27.7	27.7	27.7	27.7	25.8	24	24	23	21.5	38972
621.1	32.7	32.7	32.7	32.7	30.8	29	29	28	26.5	50855
631.1	42.7	42.7	42.7	42.7	40.8	39	39	38	36.5	77615
641.1	52.7	52.7	52.7	52.7	50.8	49	49	48	46.5	107925

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 6 OF

NEWFOUND LAKE DAM JOB NO. 12117-001

SPILLWAY & OVERTOP RATING CURVE BY MAS DATE 8

ELEV FEET	HEAD ON SPILLWAY CREST, FT	H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8	Q
588.4	0	0								0
588.7	0.3	0.3	0.3	0.3						313
589.4	1.0	1.0	1.0	1.0						643
590.3	1.9	1.9	1.9	1.9						935
590.7	2.3	2.3	2.3	2.3	0.4					1086
591.6	3.2	3.2	3.2	3.2	1.3					1573
592.1	3.7	3.7	3.7	3.7	1.8					1711
593.1	4.7	4.7	4.7	4.7	2.8	1	1			2185
594.1	5.7	5.7	5.7	5.7	3.8	2	2	1		2827
594.6	6.2	6.2	6.2	6.2	4.3	2.5	2.5	1.5		3188
595.1	6.7	6.7	6.7	6.7	4.8	3.0	3.0	2.0	.5	3596
596.1	7.7	7.7	7.7	7.7	5.8	4.0	4.0	3.0	1.5	4228
601.1	12.7	12.7	12.7	12.7	10.8	9.0	9.0	8.0	6.5	10696

NEWFOUND LAKE DAM

SPILLWAY + CREEK DISCHARGE RATING CURVE

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT NEW HAMPSHIRE DAM INSPECTION — SHEET NO. ____ OF ____
NEWFOUND LAKE DAM — JOB NO. 10-937-0
COMPUTED BY ROTH — CHECKED BY ____ — DATE AUG 1979

TAILWATER RATING CURVE:

(Data By NH-WRB)

GAGE READING FT	DISCHARGE CFS	ESTIMATED ELEV* (By Harris-ECI)
4.3	45	581.4
5.0	165	582.1
6.0	440	583.1
7.0	820	584.1
8.0	1280	585.1
9.0	1780	586.1
9.7	2180	586.9

* Elevations are estimated only, and are affected by the uncertainty of the correlation of Newfound Lake levels in the main part of the lake and at the upstream face of the dam.

NEWFOUND LAKE DAM

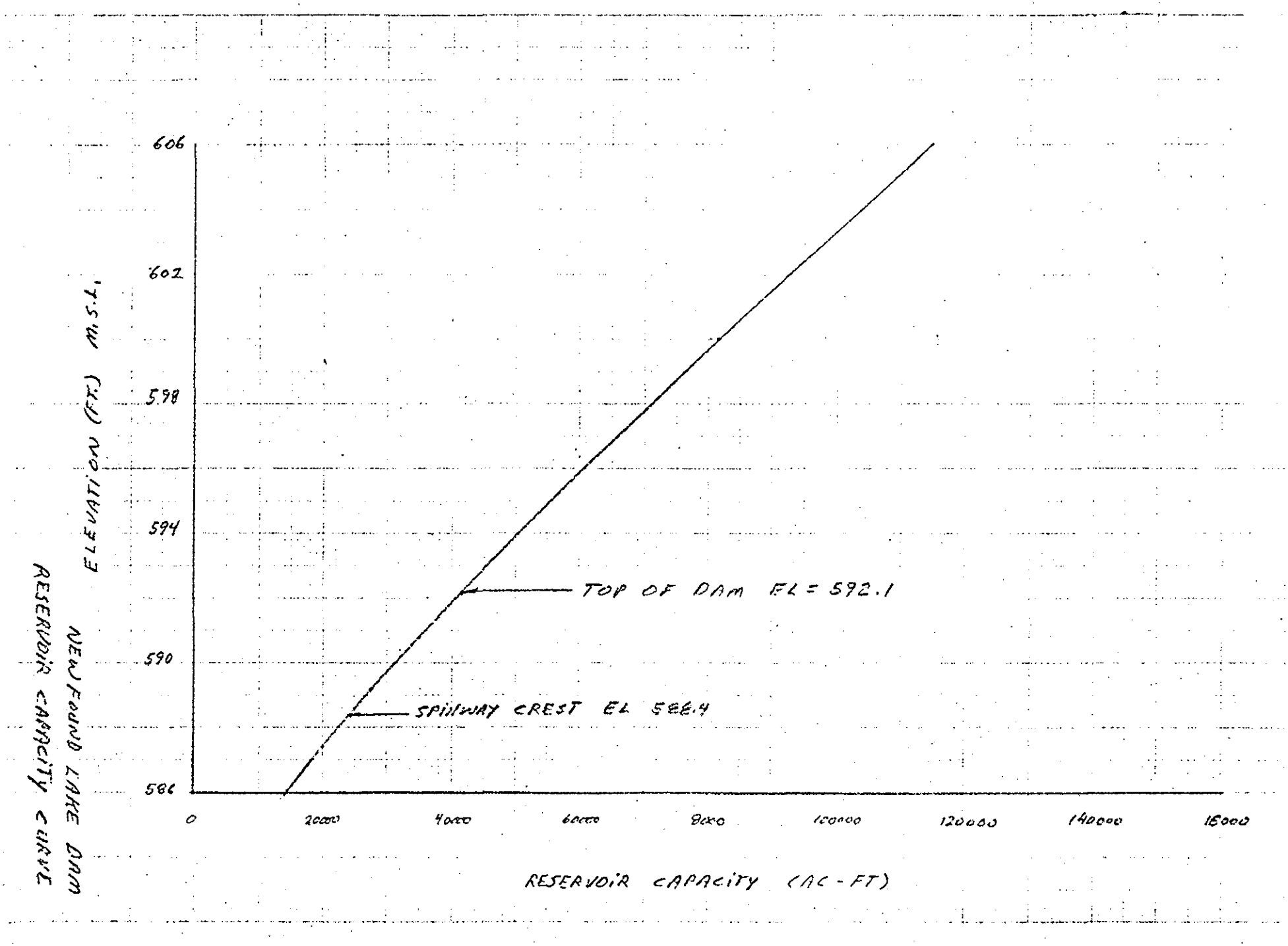
RESERVOIR AREA - CAPACITY

Reservoir Storage = 27,715 AF at El 589.12

Top of dam at El 592.1

Recreation pool at El 588.4.

ELEVATION FEET	RESERVOIR AREA ACRES	RESERVOIR CAPACITY ACRE-FT	REMARKS
586	4224	14256	
588.4	4360	24557	RECREATION POOL
589.12	4410	27715	
592.1	4670	41244	TOP OF DAM
600.0	5568	81684	
610	6960	144324	


606
602
598
594
590
586
ELEVATION (FT) M.S.L.
TOP OF DAM EL = 592.1
SPILLWAY CREST EL 588.4
0
20000
40000
60000
80000
100000
120000
140000
160000
RESERVOIR CAPACITY (AC-FT)
NEW FOUND LAKE DAM
RESERVOIR CAPACITY CURVE

CI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 1 OF 5
NEWFOUND LAKE DAM JOB NO. 1211-001-1
DAM FAILURE STUDY BY KLB DATE 8-3-78

NEWFOUND LAKE DAM

EFFECT OF DAM FAILURE

STEP 1: DETERMINE PEAK FAILURE Q_{P_1}

$$Q_{P_1} = \frac{8}{27} W_b \sqrt{2g}\, Y_o^{3/2}$$

Q_{P_1} = FAILURE OUTFLOW IN CFS.

W_b = 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT AT PMF

Y_o = TOTAL HEIGHT FROM RIVER BED TO TOP OF DAM

Y_o = 592 (TOP OF DAM) − 580 (RIVER BED, ASSUMED) = 12 FT.

DAM LENGTH AT MID HEIGHT ≈ 102 FT (±) (FROM SKETCHES)

∴ W_b = 0.40 × 102.0 = 40.8 FT (±)

$$Q_{P_1} = \frac{8}{27}(40.8)\sqrt{64.4}\,(12.0)^{3/2}$$

Q_{P_1} = 4000 CFS

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION — SHEET NO. 2 OF 5
NEWFOUND LAKE DAM — JOB NO. 1211-001-1
DAM FAILURE STUDY — BY KLB DATE 8-3-78

STEP 2: DEVELOP STAGE DISCHARGE CURVES FOR THE DOWNSTREAM CHANNEL AT THE END OF EACH REACH, ASSUME UNIFORM FLOW, AND MANNINGS $n = 0.10$. THE STAGE DISCHARGE CURVES FOR THE NEWFOUND LAKE CHANNEL ARE ON PAGES 3 THROUGH 5

STEP 3: DETERMINE STAGE CORRESPONDING TO Q_p, AT EACH SECTION, ASSUMING THE STAGE DISCHARGE CURVE IS VALID FOR UNSTEADY FLOW CASE.

PEAK DISCHARGE = Q_p = 40000 CFS

DISTANCE FROM DAM, (MILES)	0.38 (2000 FT)	1	2
STAGE, (FEET)	9.0	8.2	9.6

E-4 ENGINEERING CONSULTANTS, INC.

New Hampshire Dam Safety Inspection — SHEET NO. 2 OF
Newfound Lake Dam — JOB NO. 1211-001
Dam Failure Hydrograph — BY M.R.H. DATE 6/29/78

Stage H.	Area A Sq. Ft.	Wetted Perimeter W.P. Ft.	Hydraulic Radius R Ft.	$AR^{2/3}$	$Q=\frac{1.49}{n}AR^{2/3}S^{1/2}$ $Q=1.393\,AR^{2/3}$
0	0	0	0	0	0
4	160	80	2	254	350
8	640	160	4	1613	2250
12	1440	240	6	4755	6620
16	2480	310	8	9921	13820
20	3700	370	10	17175	23930

Channel Slope, S = 60/(1.3×5280) = 0.00874 ft/ft

n = 0.1

Stage - Discharge Curve is for 2 miles downstream.

24	5296	409	12	29280	40788
27	7044	448	16	41727	62309
31	8944	487	18	61430	85572
35	9443	496	?	67099	93662
36	10?36	525	21	83698	116591

EC-4 ENGINEERING CONSULTANTS, INC.

New Hampshire Dam Safety Inspection — SHEET NO. 1 OF
Newfound Lake Dam — JOB NO. 1211-001
Dam Failure Hydrograph — BY M.R.H. DATE 6/29/78

Stage ft.	Area A sq. ft.	Wetted Perimeter W.P. ft.	Hydraulic Radius R ft.	$AR^{2/3}$	$Q=\frac{1.49}{n}AR^{2/3}S^{1/2}$, $Q=1.837\,AR^{2/3}$ cu. ft./sec.
0	0	0	0	0	0
4	200	100	2	317	580
8	740	185	4	1865	3430
12	1590	265	6	5250	9650
16	2720	340	8	10880	19990
20	4100	410	10	19030	34960

Channel Slope, $S = 80/(1.0 \times 5280) = 0.0152$ ft./ft.

$n = 0.10$

Stage - Discharge curve is for 1 mile downstream

24	5900	471	12	20925	38429
28	8120	571	14	31,586	58,029
30	9200	613	15	38952	71,591
32	10410	652	16	46417	85,258

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. ____ OF ____

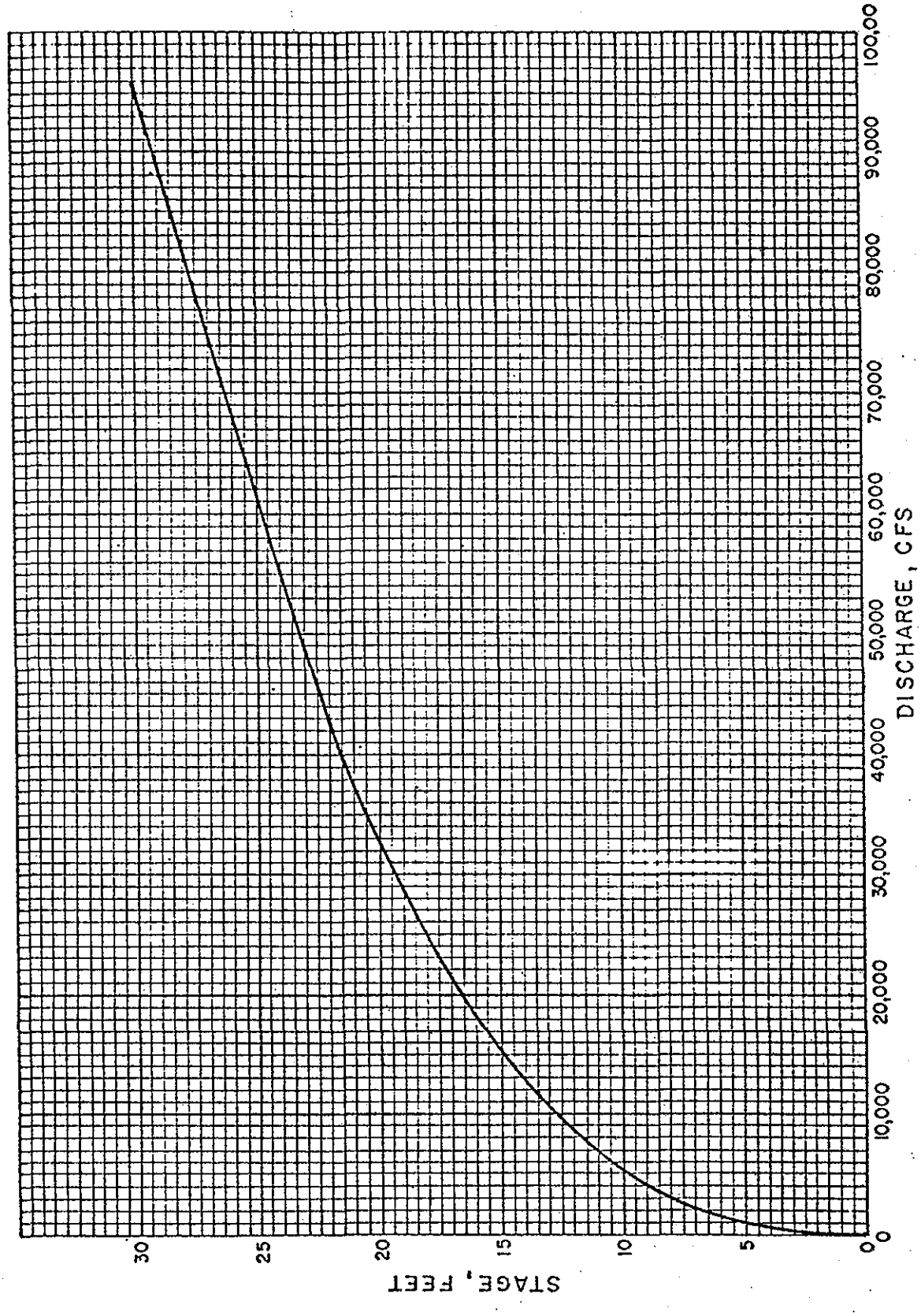
NEWFOUND LAKE DAM JOB NO. ____

STAGE DISCHARGE CURVE AT DAM SITE (2400 FT BY EBN DATE 7-19-79

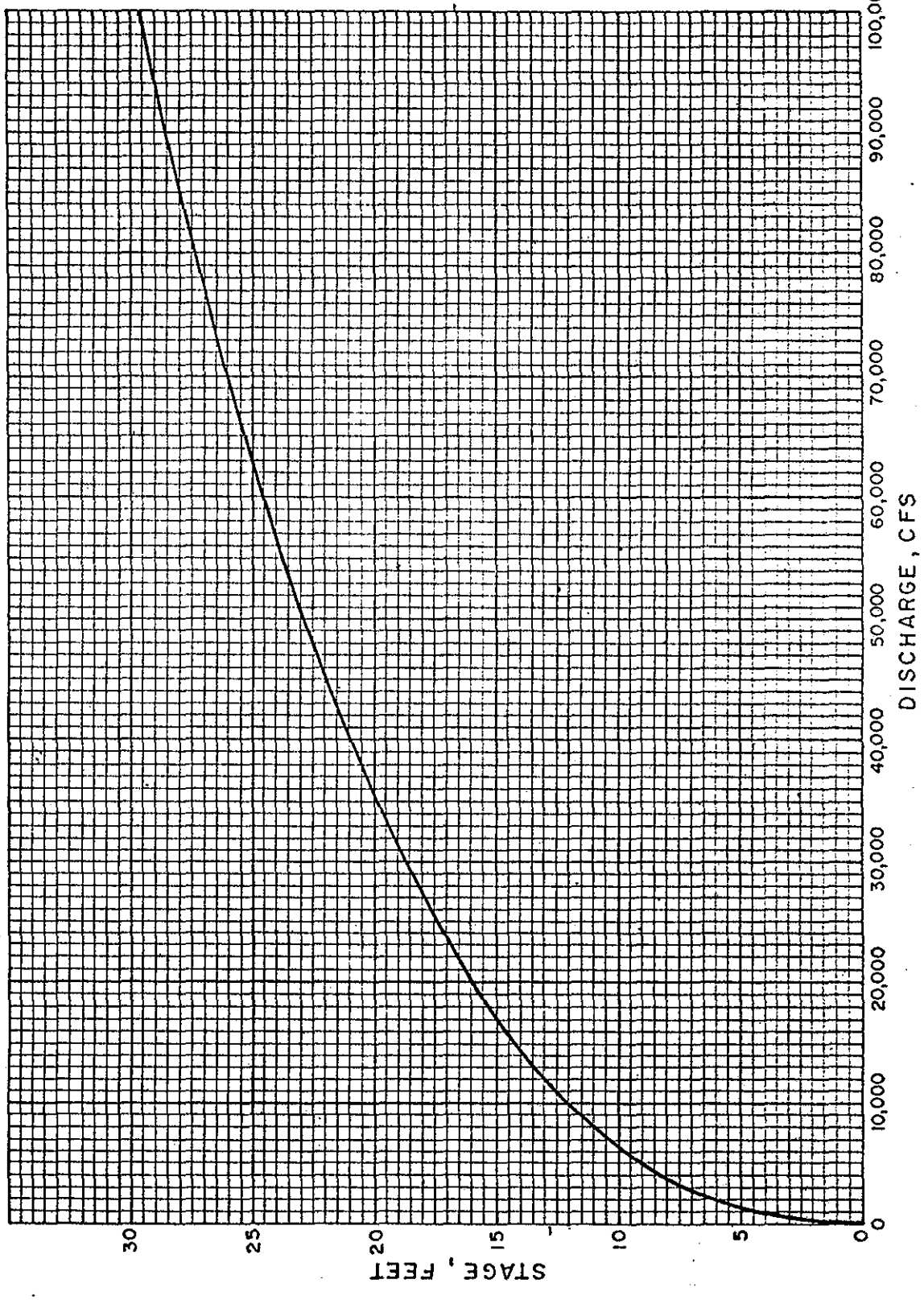
DOWNSTREAM)

STAGE - DISCHARGE DATA 2400 FT DOWNSTREAM FROM DAM SITE

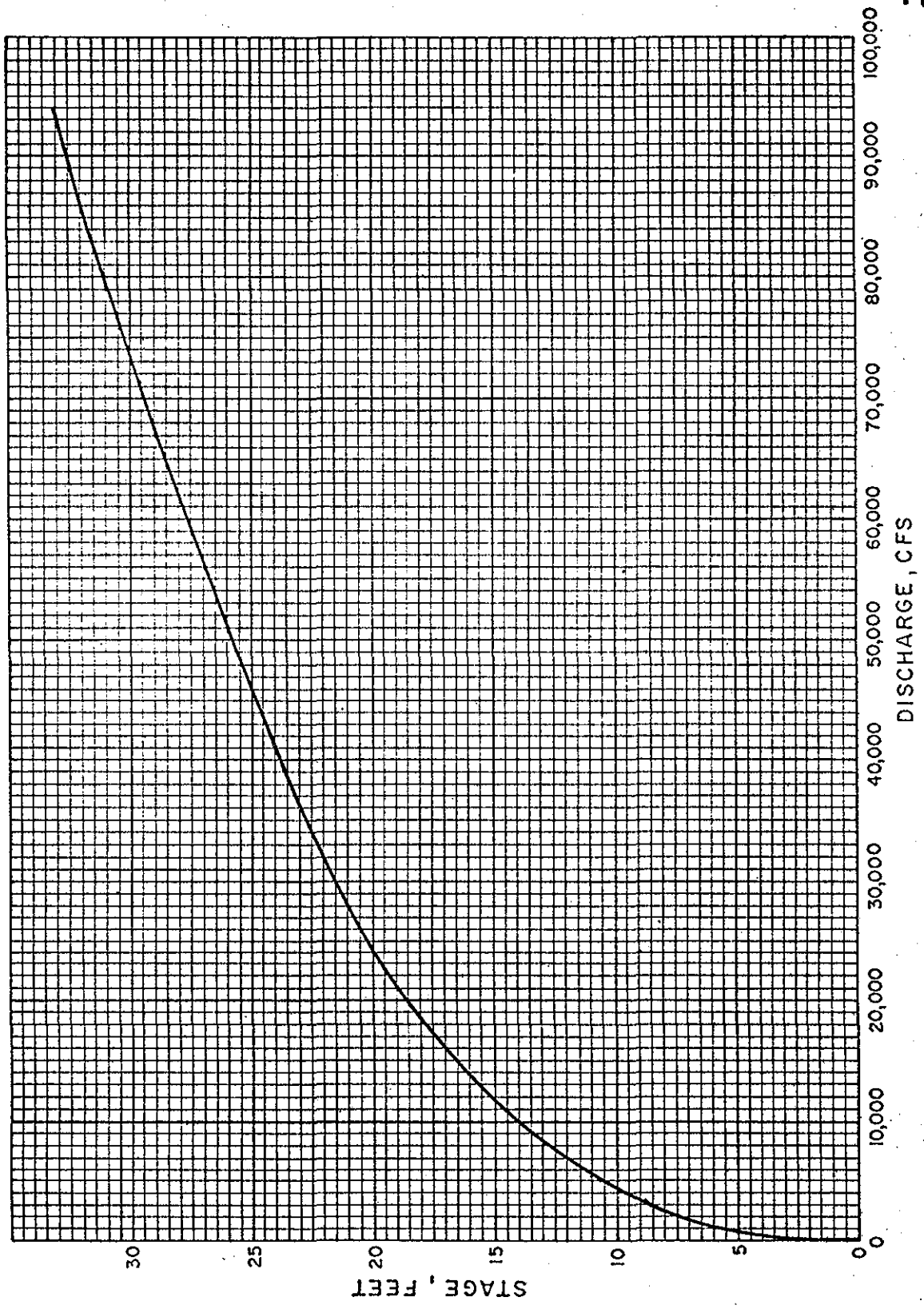
STAGE FEET	AREA A SQ FT	WETTED PERIMETER P FT	HYDRAULIC RADIUS R FT	$AR^{2/3}$	$Q = 1.49AR^{2/3}$
0	0	0	0	0	0
4	186	93	2	295	440
8	744	187	4	1875	2794
12	1674	279	6	5507	8235
16	2976	374	8	11904	17737
20	4650	467	10	21578	32159
24	6582	504	13	36390	54221
28	8658	541	16	54975	81913
30	9750	559	17	64461	96043
32	10878	578	19	77455	115408



NEWFOUND RIVER
STAGE DISCHARGE CURVE
2,000 FT. DOWNSTREAM FROM
NEWFOUND LAKE DAM



NEWFOUND RIVER
STAGE DISCHARGE CURVE
I MILE DOWNSTREAM FROM
NEWFOUND LAKE DAM



NEWFOUND RIVER
STAGE DISCHARGE CURVE
2 MILES DOWNSTREAM FROM
NEWFOUND LAKE DAM

HEC 1 – COMPUTATIONS

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. 1 OF
NEWFOUND LAKE DAM JOB NO. 1211-001-1
INPUT TO HEC-1 BY KLB DATE 9-15-

INPUT TO HEC-1

#	ELEV (FT)	HEAD ABOVE SPILLWAY CREST (FT.)	Y2 STORAGE (AC-FT)	Y3 DISCHARGE (CFS)
1	588.4 (SPILLWAY CREST)	0.	24557	0.
2	588.7	0.3	25500	310.
3	589.0	0.5	26800	450.
4	589.5	1.1	29000	675.
5	590.0	1.6	31200	780.
6	592.1 (TOP OF DAM)	3.7	41244	1700.
7	594.0	5.6	50500	2800.
8	598.0	9.6	71000	6500.
9	600.0	11.6	81684	9100.
10	606.0	17.6	115000	18500.

****
HEC-1 VERSION DATED JAN 1973
****

ASSUME SPILLWAY CAPACITY = 1700

NEWFOUND LAKE DAM

PMP	50% PMP	ROUTED PMP	ROUTED 50% PMP	OVERTOP (FT) PMP	OVERTOP (FT) 50% PMP	SPILLWAY CAPACITY %
93500	46750	16161	5834	12.70	5.30	17 % (1.77)

****
HEC-1 VERSION DATED JAN 1973
****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
NEWFOUND LAKE DAM
PMF FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	95.00	0.00	95.00	0.00	0.000	0	0	0

INPUT HYDROGRAPH

0.	3740.	7480.	11220.	14960.	18700.	22440.	26180.	29920.	33660.
37400.	41140.	44880.	48620.	52360.	56100.	59840.	63580.	67320.	71060.
74800.	78540.	82280.	86020.	89760.	93500.	89760.	86020.	82280.	78540.
74800.	71060.	67320.	63580.	59840.	56100.	52360.	48620.	44880.	41140.
37400.	33660.	29920.	26180.	22440.	18700.	14960.	11220.	7480.	3740.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	93500.	82280.	48620.	16232.	2337500.
INCHES		8.05	19.04	19.07	19.07
AC-FT		40821.	96486.	96640.	96640.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU NEWFOUND LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	24557.	25500.	26800.	29000.	31200.	41244.	50500.	71000.	81684.	115000.
OUTFLOW=	0.	310.	450.	675.	780.	1700.	2800.	6500.	9100.	18500.

TIME	EOP STOR	AVG IN	EOP OUT
1	24557.	0.	0.
2	24633.	1870.	25.
3	24862.	5610.	100.
4	25242.	9350.	225.
5	25771.	13090.	339.
6	26451.	16830.	412.
7	27282.	20570.	499.
8	28264.	24310.	599.
9	29397.	28050.	693.
10	30680.	31790.	755.
11	32115.	35530.	863.
12	33699.	39270.	1008.
13	35431.	43010.	1167.
14	37311.	46750.	1339.
15	39339.	50490.	1525.
16	41512.	54230.	1731.
17	43830.	57970.	2007.
18	46291.	61710.	2299.
19	48694.	65450.	2609.
20	51638.	69190.	3005.
21	54516.	72930.	3524.
22	57528.	76670.	4068.
23	60670.	80410.	4635.
24	63944.	84150.	5226.
25	67347.	87890.	5840.
26	70879.	91630.	6478.
27	74380.	91630.	7322.
28	77693.	87890.	8128.
29	80818.	84150.	8889.
30	83757.	80410.	9685.
31	86509.	76670.	10461.
32	89076.	72930.	11185.
33	91459.	69190.	11857.
34	93660.	65450.	12479.
35	95683.	61710.	13049.
36	97528.	57970.	13570.
37	99199.	54230.	14041.
38	100696.	50490.	14464.
39	102022.	46750.	14838.
40	103180.	43010.	15165.
41	104170.	39270.	15444.
42	104995.	35530.	15677.
43	105657.	31790.	15864.
44	106158.	28050.	16005.
45	106499.	24310.	16101.
46	106682.	20570.	16153.

47	106710.	16830.	16161.
48	106584.	13090.	16125.
49	106306.	9850.	16047.
50	105877.	6610.	15926.
51	105299.	1870.	15763.
52	104652.	0.	15580.
53	104012.	0.	15399.
54	103379.	0.	15221.
55	102754.	0.	15044.
56	102136.	0.	14870.
57	101525.	0.	14698.
58	100921.	0.	14527.
59	100324.	0.	14359.
60	99734.	0.	14192.
61	99151.	0.	14028.
62	98575.	0.	13865.
63	98005.	0.	13705.
64	97442.	0.	13546.
65	96885.	0.	13389.
66	96335.	0.	13233.
67	95792.	0.	13080.
68	95254.	0.	12928.
69	94723.	0.	12779.
70	94198.	0.	12630.
71	93679.	0.	12484.
72	93166.	0.	12339.
73	92659.	0.	12196.
74	92158.	0.	12055.
75	91663.	0.	11915.
76	91173.	0.	11777.
77	90689.	0.	11640.
78	90211.	0.	11506.
79	89738.	0.	11372.
80	89271.	0.	11240.
81	88809.	0.	11110.
82	88353.	0.	10981.
83	87902.	0.	10854.
84	87456.	0.	10728.
85	87015.	0.	10604.
86	86579.	0.	10481.
87	86149.	0.	10359.
88	85723.	0.	10239.
89	85302.	0.	10121.
90	84887.	0.	10003.
91	84476.	0.	9887.
92	84069.	0.	9773.
93	83668.	0.	9659.
94	83271.	0.	9547.
95	82879.	0.	9437.
96	82491.	0.	9327.
97	82108.	0.	9219.
98	81729.	0.	9112.
99	81354.	0.	9019.
100	80984.	0.	8929.
101	80616.	0.	8840.
102	80253.	0.	8751.
103	79893.	0.	8664.
104	79537.	0.	8577.
105	79184.	0.	8491.
106	78835.	0.	8406.
107	78489.	0.	8322.

108	78147.	0.	8239.
109	77808.	0.	8156.
110	77473.	0.	8075.
111	77141.	0.	7994.
112	76812.	0.	7914.
113	76487.	0.	7835.
114	76165.	0.	7756.
115	75846.	0.	7679.
116	75530.	0.	7602.
117	75217.	0.	7526.
118	74908.	0.	7451.
119	74602.	0.	7376.
120	74298.	0.	7302.
121	73998.	0.	7229.
122	73701.	0.	7157.
123	73407.	0.	7085.
124	73115.	0.	7014.
125	72827.	0.	6944.
126	72541.	0.	6875.
127	72259.	0.	6806.
128	71979.	0.	6738.
129	71702.	0.	6670.
130	71427.	0.	6604.
131	71156.	0.	6538.
132	70887.	0.	6479.
133	70620.	0.	6431.
134	70355.	0.	6383.
135	70092.	0.	6336.
136	69832.	0.	6289.
137	69573.	0.	6242.
138	69316.	0.	6196.
139	69061.	0.	6150.
140	68807.	0.	6104.
141	68556.	0.	6058.
142	68307.	0.	6013.
143	68059.	0.	5969.
144	67813.	0.	5924.
145	67569.	0.	5880.
146	67327.	0.	5837.
147	67087.	0.	5793.
148	66848.	0.	5750.
149	66612.	0.	5708.
150	66377.	0.	5665.
SUM			1328252.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16161.	15904.	13965.	9216.	1328252.
INCHES		1.55	5.46	10.82	10.83
AC-FT		7890.	27714.	54869.	54914.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	93500.	82280.	48620.	16252.	95.00
ROUTED TO	1	16161.	15904.	13965.	9216.	95.00

****
HEC-1 VERSION DATED JAN 1973
****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
NEWFOUND LAKE DAM
ONE HALF PMF FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

**********   **********   **********   **********   **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	95.00	0.00	95.00	0.00	0.500	0	0	0

INPUT HYDROGRAPH

0.	3740.	7480.	11220.	14960.	18700.	22440.	26180.	29920.	33660.
37400.	41140.	44880.	48620.	52360.	56100.	59840.	63580.	67320.	71060.
74800.	78540.	82280.	86020.	89760.	93500.	89760.	86020.	82280.	78540.
74800.	71060.	67320.	63580.	59840.	56100.	52360.	48620.	44880.	41140.
37400.	33660.	29920.	26180.	22440.	18700.	14960.	11220.	7480.	3740.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	93500.	82280.	48620.	16232.	2337500.
INCHES		8.05	19.04	19.07	19.07
AC-FT		40821.	96486.	96640.	96640.

RUNOFF MULTIPLIED BY 0.50

0.	1870.	3740.	5610.	7480.	9350.	11220.	13090.	14960.	16830.
18700.	20570.	22440.	24310.	26180.	28050.	29920.	31790.	33660.	35530.
37400.	39270.	41140.	43010.	44880.	46750.	44880.	43010.	41140.	39270.
37400.	35530.	33660.	31790.	29920.	28050.	26180.	24310.	22440.	20570.
18700.	16830.	14960.	13090.	11220.	9350.	7480.	5610.	3740.	1870.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	46750.	41140.	24310.	8116.	1168750.
INCHES		4.02	9.52	9.53	9.53
AC-FT		20410.	48243.	48320.	48320.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU NEWFOUND LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	24557.	25500.	26800.	29000.	31200.	41244.	50500.	71000.	81684.	115000.
OUTFLOW=	0.	310.	450.	675.	780.	1700.	2800.	6500.	9100.	18500.

TIME	EOP STOR	AVG IN	EOP OUT
1	24557.	0.	0.
2	24595.	935.	12.
3	24709.	2805.	50.
4	24899.	4675.	112.
5	25163.	6545.	199.
6	25500.	8415.	310.
7	25912.	10285.	354.
8	26398.	12155.	406.
9	26960.	14025.	466.
10	27596.	15895.	531.
11	28307.	17765.	604.
12	29091.	19635.	679.
13	29951.	21505.	720.
14	30886.	23375.	765.
15	31896.	25245.	843.
16	32980.	27115.	943.
17	34136.	28985.	1049.
18	35366.	30855.	1161.
19	36668.	32725.	1280.
20	38042.	34595.	1406.
21	39488.	36465.	1539.
22	41005.	38335.	1678.
23	42593.	40205.	1860.
24	44251.	42075.	2057.

25	45978.	43945.	2262.
26	47773.	45815.	2475.
27	49559.	45815.	2688.
28	51259.	43945.	2937.
29	52870.	42075.	3227.
30	54393.	40205.	3502.
31	55827.	38335.	3761.
32	57173.	36465.	4004.
33	58432.	34595.	4231.
34	59605.	32725.	4443.
35	60693.	30855.	4639.
36	61695.	28985.	4820.
37	62613.	27115.	4986.
38	63447.	25245.	5136.
39	64198.	23375.	5272.
40	64866.	21505.	5392.
41	65452.	19635.	5498.
42	65957.	17765.	5589.
43	66382.	15895.	5666.
44	66726.	14025.	5728.
45	66990.	12155.	5776.
46	67176.	10285.	5809.
47	67283.	8415.	5829.
48	67313.	6545.	5834.
49	67265.	4675.	5825.
50	67140.	2805.	5803.
51	66940.	935.	5767.
52	66703.	0.	5724.
53	66467.	0.	5681.
54	66233.	0.	5639.
55	66001.	0.	5597.
56	65770.	0.	5556.
57	65542.	0.	5514.
58	65315.	0.	5473.
59	65089.	0.	5433.
60	64865.	0.	5392.
61	64643.	0.	5352.
62	64423.	0.	5313.
63	64204.	0.	5273.
64	63987.	0.	5234.
65	63772.	0.	5195.
66	63558.	0.	5156.
67	63346.	0.	5118.
68	63135.	0.	5080.
69	62926.	0.	5042.
70	62718.	0.	5005.
71	62512.	0.	4968.
72	62307.	0.	4931.
73	62104.	0.	4894.
74	61903.	0.	4858.
75	61703.	0.	4822.
76	61504.	0.	4786.
77	61307.	0.	4750.
78	61112.	0.	4715.
79	60918.	0.	4680.
80	60725.	0.	4645.
81	60534.	0.	4611.
82	60344.	0.	4576.
83	60155.	0.	4542.
84	59968.	0.	4509.
85	59783.	0.	4475.

86	59598.	0.	4442.
87	59416.	0.	4409.
88	59234.	0.	4376.
89	59054.	0.	4343.
90	58875.	0.	4311.
91	58697.	0.	4279.
92	58521.	0.	4247.
93	58346.	0.	4216.
94	58173.	0.	4184.
95	58001.	0.	4153.
96	57830.	0.	4122.
97	57660.	0.	4092.
98	57491.	0.	4061.
99	57324.	0.	4031.
100	57158.	0.	4001.
101	56993.	0.	3972.
102	56830.	0.	3942.
103	56667.	0.	3913.
104	56506.	0.	3884.
105	56346.	0.	3855.
106	56188.	0.	3826.
107	56030.	0.	3798.
108	55874.	0.	3769.
109	55719.	0.	3741.
110	55565.	0.	3714.
111	55412.	0.	3686.
112	55260.	0.	3659.
113	55109.	0.	3631.
114	54960.	0.	3605.
115	54811.	0.	3578.
116	54664.	0.	3551.
117	54518.	0.	3525.
118	54373.	0.	3499.
119	54229.	0.	3473.
120	54086.	0.	3447.
121	53944.	0.	3421.
122	53803.	0.	3396.
123	53663.	0.	3370.
124	53524.	0.	3345.
125	53386.	0.	3321.
126	53250.	0.	3296.
127	53114.	0.	3271.
128	52979.	0.	3247.
129	52846.	0.	3223.
130	52713.	0.	3199.
131	52581.	0.	3175.
132	52450.	0.	3152.
133	52321.	0.	3128.
134	52192.	0.	3105.
135	52064.	0.	3082.
136	51937.	0.	3059.
137	51811.	0.	3036.
138	51686.	0.	3014.
139	51562.	0.	2991.
140	51439.	0.	2969.
141	51317.	0.	2947.
142	51195.	0.	2925.
143	51075.	0.	2903.
144	50955.	0.	2882.
145	50837.	0.	2860.
146	50719.	0.	2839.

147	50602.	0.	2818.	
148	50486.	0.	2798.	
149	50370.	0.	2784.	
150	50256.	0.	2771.	
SUM			548196.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5834.	5757.	5258.	3802.	548196.
INCHES		0.56	2.05	4.46	4.47
AC-FT		2856.	10435.	22636.	22664.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	46750.	41140.	24310.	8116.	95.00
ROUTED TO	1	5834.	5757.	5258.	3802.	95.00

****
HEC-1 VERSION DATED JAN 1973
****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
NEWFOUND LAKE DAM
PERCENT PMF FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	4	0

JOPER NWT
5 0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRIANGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	95.00	0.00	95.00	0.00	0.190	0	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU NEWFOUND DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	24557.	25500.	26800.	29000.	31200.	41244.	50500.	71000.	81604.	115000.
OUTFLOW=	0.	310.	450.	675.	780.	1700.	2800.	6500.	9100.	18500.

********** ********** ********** ********** **********

RUNOFF SUMMARY: AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	17765.	15655.	9237.	3084.	95.00
ROUTED TO	1	1679.	1665.	1586.	1292.	95.00

1901 SOUTH NAVAJO, DENVER, COLORADO 80223

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
NH	137	NED	NH	009	02				NEWFOUND LAKE DAM	4537.0	7144.6	15	OCT	78

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	NEWFOUND LAKE

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	05	NEWFOUND RIVER	BRISTOL	2	1670

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
CITBCRPG	1846	RC	12	9	40000	27715	NED	N	N	N	N	

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	148	C	57	600												

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
NH WATER RES BD		

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(53) INSPECTION BY	(54) INSPECTION DATE DAY	MO	YR	(55) AUTHORITY FOR INSPECTION
HARRIS-ECI ASSOCIATES	05	JUN	78	PL 92-367

(56) REMARKS